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U.S. Department of Transportation
Docket Management System
1200 New Jersey Ave S.E.
Washington, D.C. 20590

April 23, 2015

Re: Request for Exemption under Section 333 of the FAA Modernization and Reform Act of 2012 and Part 11 of the Federal Aviation Regulations from Certain Provisions of 14 C.F.R.

Dear Sir or Madam:

Pursuant to Section 333 of the FAA Modernization and Reform Act of 2012 (the Reform Act) and 14 C.F.R. Part 11, Antonelli Law files this petition for exemption on behalf of UA TacSolutions, LLC (“TacSolutions”). TacSolutions sells, services and inspects Small Unmanned Aircraft Systems (“UAs”). It seeks an exemption from the Federal Aviation Regulations (“FARs”) listed in Appendix A to allow commercial operation of its UAs, so long as such operations are conducted within and under the conditions outlined herein or as may be established by the FAA in a grant of this petition. The commercial operations will be for purposes of conducting TacSolutions’ UA sales and maintenance business, including but not limited to, demonstrating the capabilities of the UA to potential customers, and test flying customers’ UA after TacSolutions performs servicing or inspection operations on the UA.

Approval of the exemption for petitioner will allow commercial operation of (1) the Aerialtronics Altura Zenith ATX8 and (2) the CyberQuad Maxi in Class G airspace nationwide unless otherwise prescribed by an Air Traffic Organization (ATO) issued COA. The UAs covered by this petition are small battery-powered craft, with the Aerialtronics Altura Zenith ATX8 weighing approximately 18.7 lbs. (8.5 kg.) and the CyberQuad Maxi weighing approximately 17.6 lbs. (8 kg.), inclusive of battery and payload. The Aerialtronics Altura Zenith ATX8 has previously been approved for commercial operations in Exemption Nos. 11175, 11188, and 11237. Operation of the UA under the strict conditions proposed below will provide an equivalent level of safety, as Congress intended, while still allowing commercial operations. Operations using these UAs are far safer than conventional operations conducted with helicopters and fixed-wing aircraft that weigh thousands of pounds, carry highly flammable fuel, and operate in close proximity to the ground, trees, infrastructure, and people.

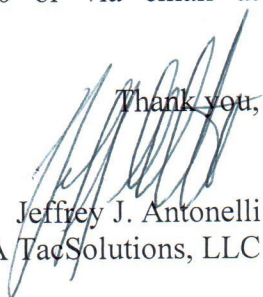
Congress directed the FAA to consider seven factors in deciding whether to approve Section 333 exemption petitions - size, weight, speed, operational capability, proximity to airports, proximity to populated areas, and operation within visual line of sight. In this case, each factor

supports the exemption request. In particular, the UA is small, and will operate at slow speeds and close to the ground. It will be able to more safely and efficiently conduct operations that would otherwise involve risk of injury or death. The substantial increase of safety and decrease of risk to human life and to property weighs heavily in favor of granting the exemption.

Pursuant to 14 C.F.R. §11.35, petitioner requests confidential treatment for certain information provided with this request for exemption. Specifically, petitioner is submitting its proprietary user and safety manuals and flight log booklet under separate cover as Exhibits 1-4 and 12. It requests that the information contained in those exhibits not be made public because they are trade secrets whose disclosure would harm petitioner. They contain valuable commercial data this is not publically available and are protected from release under the Freedom of Information Act, 5 U.S.C. §552(b)(4).

For your ease in reviewing this petition, please refer to the table of contents which begins on page 3. If we can provide any additional information to assist your understanding or review of this document, please do not hesitate to contact us at 312-201-8310 or via email at jeffrey@antonelli-law.com.

Thank you,


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Exhibit List

Exhibits pertaining to the Aerialtronics Altura Zenith ATX8 and the CyberQuad Maxi

Exhibit 1: UA TacSolutions LLC Safety Manual.....	Submitted confidentially to the FAA
Exhibit 2: UA TacSolutions, LLC Operations Manual	Submitted confidentially to the FAA
Exhibit 3: MikroKopter Flight Controller User Manual.....	Submitted confidentially to the FAA
Exhibit 4: MikroKopter GPS User Manual	Submitted confidentially to the FAA
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Exhibit 6: Flight Log Booklet	Submitted confidentially to the FAA
Exhibit 7: PIC Training Syllabus	Submitted confidentially to the FAA

Exhibits pertaining only to the Aerialtronics Altura Zenith ATX8

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Exhibit 11: Graupner MX-20 Transmitter Programming Manual	
.....	Submitted separately due to upload constraints

Exhibits pertaining only to the CyberQuad Maxi

Exhibit 12: CyberQuad Flight Manual	Submitted confidentially to the FAA
Exhibit 13: CyberQuad Maxi UAV Portfolio	51
Exhibit 14: Graupner MC-20 Transmitter Programming Manual	
.....	Submitted separately due to upload constraints
Exhibit 15: Graupner MC-20 Transmitter User Manual.....	53

Exhibits 1-4, 6-7, and 12 have been submitted confidentially to the FAA and are not available to the public.

Exhibits 11 and 14 have been uploaded separately due to file size constraints.

I. Publishable Summary

Pursuant to 14 C.F.R. §11, the following summary is provided for publication in the Federal Register, should it be determined that publication is needed:

Petitioner seeks an exemption from the following rules:

14 C.F.R. 21(h); 14 C.F.R. 43.7; 14 C.F.R. 43.11; 14 C.F.R. 45.11; 14 C.F.R. 45.27; 14 C.F.R. 45.29; 14 C.F.R. 91.7(a); 14 C.F.R. 91.9(b)(2); 14 C.F.R. 91.9(c); 14 C.F.R. 91.103(b)(2); 14 C.F.R. 91.105; 14 C.F.R. 91.109; 14 C.F.R. 91.113(b); 14 C.F.R. 91.119(b) and (c); 14 C.F.R. 91.121; 14 C.F.R. 91.151(a); 14 C.F.R. 91.203(a) and (b); 14 C.F.R. 91.215; 14 C.F.R. 91.403; 14 C.F.R. 91.405(a); 14 C.F.R. 91.407(a)(1); 14 C.F.R. 409(a)(1) and (2); and 14 C.F.R. 91.417(a) and (b) to operate commercially a small unmanned aircraft system (UA) (19lbs or less).

Approval of the exemption requested by petitioner will allow commercial operation of the Aerialtronics Zenith ATX8 and the CyberQuad Maxi in Class G airspace nationwide. The commercial operations will be for purposes of conducting petitioner's UA sales and maintenance and training business, including but not limited to, demonstrating the capabilities of the UAs to potential customers, and test flying customers' UAs after petitioner performs servicing or inspection operations on the UA. The requested exemption should be granted because operation of small UAs, with the Aerialtronics Altura Zenith ATX8 weighing approximately 18.7 lbs. (8.5 kg.) and the CyberQuad Maxi weighing approximately 17.6 lbs. (8 kg.), inclusive of battery and payload, conducted in the strict conditions outlined below, will provide an equivalent level of safety, while still allowing commercial operations. The seven factors Congress directed the FAA to consider when approving Section 333 exemption petitions - size, weight, speed, operational capability, proximity to airports, proximity to populated areas, and operation within visual line of sight – each support the request. In particular, the aircraft are small, and will operate at slow speeds, and close to the ground. The substantial increase of safety and decrease of risk to human life, coupled with the low risk use of UAs to conduct these operations, weigh heavily in favor of granting the exemption.

II. Petitioner's Contact Information

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III. Proposed Operations

A. The UAs

The requested exemption will permit petitioner to operate (1) the Aerialtronics Altura Zenith ATX8 and (2) the CyberQuad Maxi.

This petition, along with Exhibits 1-6 and 11-14, which include the supporting documentation of the UAs, are hereinafter referred to as the “operating documents.” The specific conditions of the proposed exemption that relate to the characteristics of the UAs are numbers 1, 5, and 16-20 in Section V below. Each has been adopted or imposed by the FAA in numerous previous grants of Section 333 exemption petitions.

1. Aerialtronics Altura Zenith ATX8

The requested exemption will permit petitioner to operate the Aerialtronics Zenith ATX8, with a maximum weight of approximately 18.7 lbs. (8.5 kg), inclusive of batteries and technical payload. This rotorcraft operates at a speed of no more than 19.4 knots and has the capability to hover and move in the vertical and horizontal planes simultaneously.

This UA will have the following specifications or equivalent:

Airframe: Aerialtronics Altura Zenith ATX8

Control System: MikroKopter based controller, which includes the navigation system and GPS unit.

Transmitter (Tx): Graupner MX-20

Receiver (Rx): Graupner HoTT GR-24

Motors: eight MT 4008-12 electric brushless motors

Propellers: 16” x 4 MN APC Tractor; 16” x 4 MN APC Pusher

Data link: xBee 868 MHZ

Video Link: AT-Video 5.8 GHZ

OSD: available on a dedicated mobile device, allowing live telemetry to be displayed, including the battery level and altitude.

Gimbal: AV series 2-axis

Batteries: Lithium polymer batteries with capacity of 16,600 mAh

For more information regarding this UA, its transmitter, and receiver, please refer to Exhibit 2, Part B and Appendix E; and Exhibits 3-5 and 8-11. The FAA has previously approved commercial operations of the Aerialtronics Altura Zenith ATX8 in Exemption Nos. 11175, 11188, and 11237.

2. CyberQuad Maxi

The requested exemption will also permit petitioner to operate the CyberQuad Maxi, with a maximum weight of 17.6 lbs. (8 kg.), inclusive of batteries and technical payload. This operates at a speed of no more than 33 knots and has the capability to hover and move in the vertical and horizontal planes simultaneously.

The UA will have the following specifications or equivalent:

Airframe: CyberQuad Maxi

Control System: MikroKopter based control system, which includes the navigation system and GPS unit.

Tx: Graupner MC-20

Rx: Graupner HoTT GR-24

Motors: four custom designed CyberTechnology motors

Propellers: 10" x 4

Data Link: internal to the Graupner HoTT 2.4GHz receiver system

Video Link: 5.8 GHz

OSD: integrated into the Tx, allowing live telemetry to be displayed to the PIC, including the battery level and altitude

Batteries: 4.5 Ah 4S Lithium polymer batteries

For more information regarding the CyberQuad Maxi, its transmitter and receiver, please refer to Exhibits 3-5 and 12-15.

B. The Crew

The crew will consist of a pilot in command (PIC) and a visual observer (VO). The PIC and VO will have been trained in operation of UAs generally and received up-to-date information on the UAs to be operated pursuant to this grant.

The PIC will have, at minimum, a sport pilot's license and a third class medical certificate or U.S. driver's license. The PIC and VO will have received additional training as described in:

Exhibit 1, Section 5: Safety Training;

Exhibit 2, Part A, Section 5: Qualification Requirements; and

Exhibit 7, PIC Training Syllabus.

The specific conditions of the proposed exemption that relate to the training and characteristics of the crew are numbers 3 and 6-9 in Section V below. Each has been adopted or imposed by the FAA in numerous previous grants of Section 333 exemption petitions.

C. Flight Conditions

The UA operations will involve sales demonstrations and testing after servicing or inspection of customer-owned products and will take place in Class G airspace (unless as prescribed by an ATO-issued COA) under 400 feet above ground level ("AGL") and under controlled conditions over property that is restricted as set out in Exhibit 2, Section 8.2: Ground handling instructions. Petitioner will work with the local FSDO when planning operations. Petitioner will only operate its UA in visual meteorological conditions (VMC). The UA will at all times be no less than 500 feet below and no less than 2,000 feet horizontally from a cloud, and petitioner will not conduct operations unless visibility is at least 3 statute miles from the PIC. The flight crew will always make a safety assessment of the risk of every operation, and will only operate when it is determined that no undue hazards are present.

Please refer to the following operating documents for more information about the flight

conditions:

Exhibit 2, Part A:

Section 8.1.2: Weather minima

Section 8.3.1: Adverse and potentially hazardous weather conditions

Section 8.4: All weather conditions

Section 8.8: VFR flight rules

Section 8.9: Flight planning

Exhibit 12:

Section 4.6: Weather and environment

The specific conditions of the proposed exemption that relate to the flight conditions in which the UA will be operated are numbers 2, 4, 16, and 26-27 in Section V below. Each has been adopted or imposed by the FAA in numerous previous grants of Section 333 exemption petitions.

D. Flight Operations

The purpose of every UA flight will be to conduct either sales demonstrations or testing of a specific customer's UA after inspections or servicing, and to do so in an efficient and safe manner.

Every UA flight will use at minimum a two person flight crew: a PIC and a VO. The standard operational procedures that they will follow are set out in the operating documents, specifically Exhibits 1-2 and 12. Please refer to the following sections for information pertaining to operations:

Exhibit 1

Section 2.4: Incident management and investigation

Section 3: Risk management

Exhibit 2, Part A:

Section 7: Flight time limitations

Section 7.1: Maintenance

Section 8: Operating procedures

Section 11: Handling, notifying and reporting occurrences

For information specifically pertaining to the Aerialtronics Altura Zenith ATX8, please refer to the following exhibits:

Exhibit 2, Part B

Section 2: Normal Procedures

Section 3: Abnormal and Emergency Procedures

Exhibit 2, Appendix F: Checklists

For information specifically pertaining to the CyberQuad Maxi, please refer to the following exhibits:

Exhibit 12

Section 5: Flight Theory and Operation

Section 7: Daily Inspection

Section 8: Pre-Flight Procedure

Section 9: Post-Flight Procedures

The CyberQuad Maxi will have the same "loss of control link" capability and operating

procedure as the Aerialtronics Altura Zenith ATX8. See Exhibit 2, Section 3.1: Emergency Procedures Description.

The specific conditions of the proposed exemption that relate to flight operations are numbers 11-12, 17-25, and 30-34 in Section V below. Each has been accepted or imposed by the FAA in numerous previous grants of Section 333 exemption petitions.

IV. Aircraft and Equivalent Level of Safety

Petitioner proposes that the exemption apply to UAs that have the characteristics and that operate with the limitations proposed herein. These limitations provide for a level of safety at least equivalent to or higher than manned aircraft operations under the current regulatory structure. Section V below identifies the limitations and conditions to which petitioner agrees to be bound when conducting commercial operations under a grant of this petition. Appendix A contains a matrix connecting (i) the specific proposed condition with (ii) the FAR provision for which it provides an equivalent level of safety and (iii) one or more recent Section 333 exemption grants in which the FAA recognized this equivalent level of safety.

Approval of the commercial operations outlined in this petition presents no national security issue. The PIC will possess, at minimum, a sport pilot's certificate, so he or she will have been subject to security screenings by the Department of Homeland Security.

V. Proposed Conditions of the Exemption

1. The UAs will weigh no more than (a) 18.7 lbs. (8.5 kg.) (Aerialtronics Altura Zenith ATX8) and (b) 17.6 lbs. (8 kg.) (CyberQuad Maxi), inclusive of battery and technical payload.
2. UA operations under this exemption will be limited to conducting operations for the purpose of sales demonstrations or testing in Class G airspace nationwide, unless otherwise prescribed by an ATO issued COA.
3. Flights will be operated within line of sight of a pilot and visual observer.
4. Flights will be operated at an altitude of no more than 400 feet AGL, as indicated by the procedures specified in the operating documents. All altitudes reported to ATC must be in feet AGL.
5. The UA will not be flown at an indicated airspeed exceeding 19.4 knots (Aerialtronics Altura Zenith ATX8) and 32.4 knots (CyberQuad Maxi).
6. Minimum flight crew for each operation will consist of the UA pilot in command (PIC) and a visual observer (VO).
7. The PIC will have, at minimum, a sport pilot license and a third class medical certificate or a U.S. driver's license.
8. The petitioner will not permit any PIC to operate unless the PIC meets its qualification criteria and demonstrates the ability to safely operate the UA in a manner consistent with how the UA will be operated under this exemption, including evasive and emergency maneuvers and

maintaining appropriate distances from persons, vessels, vehicles and structures. PIC qualification flight hours and currency will be logged in a manner consistent with 14 CFR § 61.51(b). A record of the PIC training will be documented and made available upon request by the Administrator. Training operations will only be conducted during dedicated training sessions. During training, proficiency, and experience-building flights, all persons not essential for flight operations will be considered nonparticipants, and the PIC will operate the UA with appropriate distance from nonparticipants in accordance with 14 CFR § 91.119.

9. The VO will not perform any other duties beyond assisting the PIC with seeing and avoiding other air traffic and other ground based obstacles/obstructions, and will not be permitted to operate the camera or other instruments.
10. The PIC will be designated before the flight and will not be allowed to transfer his or her designation for the duration of the flight. The PIC will ensure that the VO can perform the functions prescribed in these conditions and the operating documents.
11. A briefing will be conducted in regard to the planned UA operations prior to each day's activities. It will be mandatory that all personnel who will be performing duties in connection with the operations be present for this briefing.
12. Prior to each flight, the PIC will inspect the UA, including the Ground Control Station, to ensure it is in a condition for safe flight. If the inspection reveals a condition that affects the safe operation of the UA, the PIC will not operate the UA until the necessary maintenance has been performed and the UA is found to be in a condition for safe flight. All maintenance and alterations will be properly documented in the aircraft records.
13. Petitioner will conduct a functional flight test on any UA that has undergone maintenance or alterations that affect the UA operation or flight characteristics, e.g. replacement of a flight critical component. The PIC who conducts the functional test flight will make an entry in the aircraft records.
14. The petitioner will carry out its maintenance, inspections, and record keeping requirements, in accordance with the UA manufacturer's aircraft/component, maintenance, overhaul, replacement, inspection, and life limit requirements set forth in the operating documents. Maintenance, inspection, alterations, and status of replacement/overhaul component parts will be noted in the aircraft records, including total time in service, description of work accomplished, and the signature of the authorized person returning the UA to service. The authorized person will make an entry in the aircraft record of the corrective action taken against discrepancies discovered between inspections.
15. The UA will be operated within visual line of sight (VLOS) of the PIC and VO at all times. This requires the PIC to be able to use human vision unaided by any device other than corrective lenses. PIC and VO will at all times be able to communicate verbally. They will not be permitted to use electronic messaging or texting to communicate during flight operations.
16. The PIC will not begin a flight unless (considering wind and forecast weather conditions) there is enough power to fly at normal cruising speed to the intended landing point and prepare to land with 25% battery power remaining.

17. Actual total flight time for each operational flight will result in no less than a 25% battery reserve.
18. The UA will have the capability to abort a flight in case of unexpected obstacles or emergencies.
19. The UA will be programmed so that if it loses communications or loses its GPS signal, it will return to a pre-determined location within the planned operating area and land or be recovered in accordance with the operating documents
20. If the UA and its radio control link disconnect during flight, the system's failsafe protection will be triggered and the multirotor will return to home and land automatically, rather than flying off uncontrollably or landing at an unknown location.
21. The operating documents required under 14 CFR §§ 91.9 and 91.203 will be maintained and available to the PIC at the Ground Control Station of the UA any time the UA is operating. These documents will be made available to the Administrator or any law enforcement official upon request. If a discrepancy exists between the conditions and limitations in the exemption grant and the procedures outlined in the operating documents, the grant conditions and limitations will take precedence and will be followed. Otherwise, the petitioner will follow the procedures outlined in its operating documents. If it updates or revises its operating documents, it will present updated and revised documents to the Administrator upon request. If the petitioner determines that any update or revision would affect the basis upon which the FAA granted the exemption, then the Petitioner will petition for an amendment to the grant of exemption.
22. Petitioner will obtain written and/or oral permission from the landowners/authorized agents of the landowners over which flights will be conducted.
23. Petitioner will obtain all required permissions and permits from territorial, state, county or city jurisdictions, including local law enforcement, fire, or other appropriate governmental agencies.
24. UA operations will not be conducted during night, as defined in 14 CFR § 1.1. All operations will be conducted under visual meteorological conditions (VMC). Flights will not be conducted under special visual flight rules (SVFR).
25. The petitioner will obtain an Air Traffic Organization (ATO) issued Certificate of Waiver or Authorization (COA) prior to conducting any operations under the grant of exemption. Petitioner will request a Notice to Airman (NOTAM) not more than 72 hours in advance, but not less than 48 hours prior to the operation. All operations will be conducted in accordance with airspace requirements in the ATO issued COA, including class of airspace, altitude level and potential transponder requirements.
26. The UA will not be operated within 5 nautical miles of an airport reference point as denoted on a current FAA-published aeronautical chart unless a letter of agreement with that airport's management has been obtained, and the operation is conducted in accordance with a NOTAM as required by the operator's COA. Any letter of agreement with the airport management will be made available to the Administrator upon request.

27. The UA will not be operated less than 500 feet below, or less than 2,000 feet horizontally from, a cloud or when visibility is less than 3 statute miles from the PIC.
28. All operations shall be conducted in Class G airspace or as otherwise prescribed in an ATO issued COA.
29. All aircraft operated in accordance with this exemption will be identified by serial number, registered in accordance with 14 CFR part 47, and have identification (N-Number) markings in accordance with 14 CFR part 45, Subpart C. Markings will be as large as practicable.
30. Before conducting operations, petitioner will ensure that the radio frequency spectrum used for operation and control of the UA complies with the Federal Communications Commission (FCC) or other appropriate government oversight agency requirements.
31. The UA will remain clear and yield the right of way to all manned aviation operations and activities at all times.
32. The UA will not be operated by the PIC from any moving device or vehicle.
33. Petitioner will conduct all flight operations at least 200 feet from all nonparticipating persons, vessels, vehicles, and structures unless one of the following three conditions is met:
 - a. Barriers or structures are present that sufficiently protect nonparticipating persons from the UA and/or debris in the event of an accident. The petitioner will ensure that nonparticipating persons remain under such protection. If a situation arises where nonparticipating persons leave such protection and are within 500 feet of the UA, the PIC will ensure that flight operations cease immediately.
 - b. The aircraft is operated near vessels, vehicles or structures where the owner/controller of such vessels, vehicles or structures has granted permission and the PIC has made a safety assessment of the risk of operating closer to those objects and determined that it does not present an undue hazard.
 - c. Operations nearer to the PIC, VO, operator trainees or essential persons do not present an undue hazard to those persons per § 91.119(a).
34. Petitioner will report any incident, accident, or flight operation that transgresses the lateral or vertical boundaries of the operational area as defined by the applicable COA to the FAA's UAS Integration Office (AFS-80) within 24 hours. Petitioner will report accidents to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.nts.gov.

VI. Privacy

There is little concern that the proposed flights will cause invasions of privacy because all flights will occur over private property. When a UA is being flown, the onboard cameras will be focused on the ground beneath it, and thus turned so as to be facing away from any occupied structures that may be in the area to minimize inadvertent video or still images of uninvolved

persons.

All data collected will be for private use only and will not be distributed through public channels. If such data is later made available for public view, all images containing uninvolved persons will be blurred or blacked-out. No attempt will be made to identify any individuals filmed during the flights except in cases where they are trespassing upon or damaging customer property, or interfering with the petitioner's or its customers' operations.

VII. Public Interest and Safety

The planned UA use will increase ground safety for users of the Aerialtronics Altura Zenith AT8X and the CyberQuad Maxi by ensuring that the individuals who sell, conduct maintenance on, and train future users these systems are experienced on the systems, are qualified technicians, and knowledgeable trainers.

There are myriad uses for UAs such as the Aerialtronics Altura Zenith AT8X and CyberQuad Maxi. Both UAs can be used for precision agriculture, asset management, including wind turbine and power line inspections, law enforcement, and mapping and surveying operations. However, they are expensive and powerful pieces of equipment. Purchasers will want to work with experienced and qualified dealers, such as petitioner, when researching and purchasing these systems. Commercial operators of these UA systems will need a support team, such as the petitioner's, in order to ensure that their operations continue to be safe. Having experienced and qualified sales, maintenance, and training programs in the United States is in the public interest.

Petitioner has devoted significant time and resources to developing risk mitigation strategies for these UAs. Please refer to the following sections for further information:

Exhibit 1

Section 1: Safety Goals

Section 2.4: Incident management and investigation

Section 3: Risk Management

Section 4: Safety Assurance

Section 5: Safety Training

Section 6: Safety Promotion

The enhanced safety and reduced environmental impact achieved using a UA and carrying no passengers or crew, rather than a manned aircraft of significantly greater proportions, carrying crew in addition to flammable fuel, gives the FAA good cause to find that the UA operation enabled by this exemption is in the public interest.

Satisfaction of the criteria provided in Section 333 of the Reform Act of 2012 – size, weight, speed, operating capabilities, proximity to airports and populated areas and operation within visual line of sight and national security – provide more than adequate justification for the grant of the requested exemption allowing commercial operation of petitioner's UA, pursuant to TacSolutions' rules of operation.

VIII. Regulations from Which Exemption is Requested

A. Appendix A: FARs as to which TacSolutions wishes the same determination to be made as has been made previously.

FAR Provision	Applicable condition(s) in Section 5 of petition	FAA Exemption Decision
21(h)	1, 2, 3, 4, 5, 15, 24, 27, 28, 33	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11111, 11110, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11189, 11191, 11192, 11193, 11195
43.7	13, 14	No. 11208
43.11	12	No. 11208
45.11	29	No. 11208
45.27	29	No. 11188
45.29	29	Nos. 11136, 11157, 11170, 11185, 11193
91.7(a)	12	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11177, 11178, 11184, 11185, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.9(b)(2)	22	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11174, 11177, 11178, 11184, 11185, 11189, 11192, 11193, 11195
91.9(c)	30	Nos. 11136, 11170, 11171, 11174, 11185
91.103(b)(2)	3, 9, 16, 17, 18, 19, 20, 28	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11138, 11150, 11153, 11156, 11158, 11160, 11161, 11166, 11167, 11171, 11172, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.105	6	No. 11185
91.109	7, 8	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11112, 11136, 11138, 11150, 11153, 11156, 11157, 11166, 11167, 11170, 11171, 11174, 11177, 11184, 11185, 11189, 11191, 11192, 11193, 11194, 11195, 11206, 11208
91.113(b)	3, 31	No. 11238

FAR Provision	Applicable condition(s) in Section 5 of petition	FAA Exemption Decision
91.119(c)	4, 33	Nos. 11162, 11163, 11164, 11165, 11166, 111080, 111109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11160 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11178, 11185, 11188, 11189, 11190, 11193
91.121	4	Nos. 11162, 11163, 11164, 11165, 11166, 111080, 111109, 11136, 11138, 11150, 11153, 11156, 11160 11161, 11166, 11167, 11170, 11171, 11174, 11176, 11178, 11185, 11188, 11189, 11190, 11193
91.151(a)	16, 17	Nos. 11110, 11153, 11156, 11161; 111109, 11110, 11112, 11136, 11138, 11150, 11153, 11156, 11160 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11178, 11185, 11188, 11189, 11190, 11193
91.203 (a) and (b)	21	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11170, 11171, 11172, 11174, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195
91.215	25, 26	No. 11185, 11195
91.403	12, 13, 14	No. 11185
91.405(a)	12, 13, 14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.407(a)(1)	14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.409(a)(1)	12, 13, 14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.409(a)(2)	12, 13, 14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204

FAR Provision	Applicable condition(s) in Section 5 of petition	FAA Exemption Decision
91.417(a)	12, 13, 14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204
91.417(b)	12, 13, 14	Nos. 11062, 11063, 11064, 11065, 11066, 11067, 11080, 11109, 11110, 11111, 11112, 11114, 11136, 11138, 11150, 11153, 11156, 11157, 11158, 11160, 11161, 11166, 11167, 11170, 11171, 11172, 11174, 11175, 11176, 11177, 11178, 11184, 11185, 11188, 11188, 11189, 11191, 11192, 11193, 11195, 11204

Thank you for purchasing the Graupner HoTT 2.4 System Please read through this entire manual before you attempt the installation and usage of your Graupner HoTT 2.4 System!

These operating instructions are part of this product. They contains important notes to the operation and handling. Please take this into consideration when you pass on the product to third parties. Neglect of the operating instructions and the safety instructions lead to expiring the warranty.

Graupner constantly work on the advancement of all remote control systems; changes of the scope of delivery in form, technology and equipment we must reserve ourselves therefore. Please have understanding for the fact that from data and illustrations of this operating instructions no requirements can be derived. *Please keep these instructions for further reference!*

1. GENERAL NOTE

When switching on or adjusting the radio control system it is essential to keep the transmitter aerial at least 15 cm away from the receiver aerials at all times. If the transmitter aerial is too close to the receiver aerials, the receiver will be overloaded, causing the red LED on the receiver to light up. The transmitter responds by emitting a beep once every second; the red LED also goes out. The radio control system is now in Fail-Safe mode.

If this should occur, simply increase the distance between the aerials until the audible warning signal ceases, and the red LED on the transmitter lights up again; at the same time the red LED on the receiver should go out.

2. FUNCTIONS

2.1. Binding

When you wish to use the Graupner HoTT 2.4 GHz receiver with a particular transmitter, the first step must always be to “bind” the unit to “its” Graupner HoTT 2.4 GHz RF module (transmitter). This “binding” procedure only needs to be carried out once for each combination of receiver and RF module. The units supplied in the set are already bound to each other at the factory, i.e. the binding procedure described in the following section only needs to be carried out when you wish to use an additional receiver. However, it can also be repeated at any time if required, e.g. after changing transmitters. When binding is required, this is the procedure:

- Switch the transmitter and receiver on.
- Locate the BIND / RANGE button on the back of the transmitter, and hold it pressed in while you press and hold the SET button on the receiver. Both LEDs on the back of the transmitter now glow constantly, and the red LED on the receiver flashes.
- Under normal circumstances the flashing red LED on the receiver will cease to flash and switch to a constant green within about ten seconds. This indicates that the binding process is complete. You can now release both buttons, and your transmitter / receiver combination is ready for use.
- However, if the red LED on the receiver continues to flash for longer than ten seconds, then the binding process has failed. If this should occur, repeat the whole procedure.

2.1.1. Binding “multiple receivers in one model

If required, it is also possible to bind multiple receivers to the transmitter for a particular model. The first step is to bind each receiver individually using the procedure already described.

When the system is in use, the receiver which was bound last is the Master receiver. Any telemetry sensors installed in the model must be connected to this unit, as only the Master receiver transmits sensor data using the downlink channel. The second and all further receivers operate in parallel with the Master receiver but in Slave mode, with the downlink channel switched off.

The control functions can also be distributed amongst multiple receivers; this is carried out using the Channel Mapping function of the SMART-BOX (Order No. 33700). In the same way it is possible to assign one control function to multiple receiver outputs; a typical example would be the use of two servos for each aileron instead of only one, etc.

2.2. Range checking

The method of checking the effective range of the Graupner HoTT 2.4 GHz system is described below. We recommend that you ask a friend to help you with this procedure.

After binding the receiver to your transmitter, switch the transmitter and the receiver on, and wait until the green LED on the receiver lights up.

- Install the bound receiver in the model in its final intended position.
- Switch the RC system on, so that you can observe the movement of the servos.
- Set up the model on a flat surface (pavement, closely mown grass or earth), and ensure that the receiver aerials are located at least fifteen cm above the ground. This may require a support for the model.
- Hold the transmitter at hip-height, away from your body, but do not point the aerial directly at the model; instead turn and / or angle the aerial tip so that it stands vertical, and keep it there for the duration of the range check.
- Locate the BIND / RANGE button on the back of the transmitter, and press it to initiate range-check mode. Hold the button pressed in until the transmitter starts to beep at a regular rhythm; the red and green LEDs adjacent to the BIND / RANGE button now flash alternately.
- Walk away from the model, operating the transmitter sticks constantly. If you detect an interruption in the link within a range of about fifty metres, stand still and attempt to reproduce it.
- If the model is fitted with a motor, switch it on in order to check whether the power system is generating interference.
- Continue to walk away from the model until you reach the point where perfect control is no longer possible.
- Now press the BIND / RANGE button on the transmitter once more; this terminates range-check mode manually, and the model should respond normally to control commands. If this does not occur with 100% reliability, the system should not be used. Contact your local Service Department of Graupner GmbH & Co. KG.
- Range-check mode is usually terminated manually when the user presses the BIND / RANGE button, but it terminates automatically after about ninety seconds in any case. The red LED now glows constantly again, while the green LED either glows constantly or flashes continuously, according to the Country setting.
- We recommend that you check effective radio range before every flight. While you are carrying out the check, simulate all the servo movements which will take place when the model is in flight. The ground range must always be at least fifty metres in order to ensure safe, reliable model control.

Note:

Range-check mode is usually terminated manually when the user presses the BIND / RANGE button, but it terminates automatically after about ninety seconds in any case.

CAUTION:

During normal operations (i. e. when controlling a model) never press and hold the programming button on the transmitter module!

2.3. Fail-Safe function

In its default state (as delivered) the receiver is set to "Hold" mode, i.e. if a fail-safe situation occurs, all the servos connected to it maintain the last position detected as valid. In this mode the red LED on the receiver lights up when interference occurs, and the red LED on the transmitter goes out. The transmitter also starts beeping about once per second as an audible warning.

You can exploit the safety potential of the fail-safe option by at least programming the throttle channel to respond to a fail-safe situation: the throttle channel of an engine-powered model should be set to idle, the throttle channel of an electric-powered model to "stop", and the throttle channel of a model helicopter to "Hold". If interference should occur, these settings will help prevent the model flying out of control, possibly causing personal injury or property damage.

IMPORTANT:

The two functions "Binding" and "Range check" described above can be used regardless of the method you last employed to program the transmitter, i.e. using the programming button or the SMART-BOX; neither of these two options causes significant changes to the settings saved in the receiver. However,

if you call up the Fail-Safe function using the programming button as described below, this resets ALL the settings of the SMART-BOX at the Fail-Safe screen (RX FAIL SAFE) - and this includes the settings available through the facilities of the programming button. At the same time the Country setting will revert to Universal if you have previously selected "France" using the programming button - see below under "2.4". You MUST therefore select the Country setting again if necessary. For this reason, wherever possible it is always best to maintain your programmed settings using the SMART-BOX.

Switch your receiving system on. Locate the BIND / RANGE button on the back of the transmitter, and hold it pressed in while you switch the transmitter on. Release the button again once it is switched on. You can now call up the desired Fail-Safe mode (Fail-Safe on / off, Hold, or Standard) by cycling through the modes with a brief press of the BIND / RANGE button:

- **Fail-Safe mode:** when you press the BIND / RANGE button, the transmitter beeps once; the red and green LEDs glow constantly.

It is now possible to program positions to which the servos will move in a Fail-Safe situation; this occurs after a "Hold" period of 0.75 seconds: move the corresponding transmitter controls (sticks, rotary knobs, INC / DEC buttons etc.) to the desired Fail-Safe positions SIMULTANEOUSLY, then hold the BIND / RANGE button pressed in for three to four seconds. When you release the button, both the red and green LEDs should light up constantly, and the transmitter should not emit an audible signal: the transmitter now reverts to Control mode. If this does not occur, repeat the procedure.

- **Hold mode (recommended for model helicopters):** when you press the BIND / RANGE button, the transmitter beeps twice; the red LED lights up constantly, and the green LED goes out (factory default setting).

If interference occurs, all servos programmed to "Hold" remain at the last position detected by the receiver as correct; this situation is maintained until such time as the receiver picks up a new, valid control signal.

You can save your selection by holding the BIND / RANGE button pressed in for three to four seconds. When you release the button, both the red and green LEDs should light up constantly, and the transmitter should not emit an audible signal: the transmitter now reverts to Control mode. If this does not occur, repeat the procedure.

- **Fail-Safe OFF:** when you press the BIND / RANGE button, the transmitter beeps three times; the green LED glows constantly, the red LED goes out.

You can save your selection by holding the BIND / RANGE button pressed in for three to four seconds. When you release the button, both the red and green LEDs should light up constantly, and the transmitter should not emit an audible signal: the transmitter now reverts to Control mode. If this does not occur, repeat the procedure.

- **Standard mode (suitable for fixed-wing model aircraft only):** when you press the BIND / RANGE button, the transmitter beeps four times; both LEDs are off.

In this mode the throttle servo (channel 1) moves to the Fail-Safe position, i.e. the position you have programmed for a Fail-Safe situation, while all the other channels remain at "Hold".

Move the throttle stick to the desired position, then hold the BIND / RANGE button pressed in for three to four seconds. When you release the button, both the red and green LEDs should light up constantly, and the transmitter should not emit an audible signal: the transmitter now reverts to Control mode. If this does not occur, repeat the procedure.

2.4. Range warning

If the receiver signal in the down-link channel becomes too weak, the transmitter always generates an audible range warning in the form of a beep emitted about once per second. Since the transmitter's output is much higher than that of the receiver, you will still maintain full control of the model, but in the interests of safety you should fly the model back towards you until the warning signal ceases again.

If the audible range warning signal does not cease when you reduce the distance, then the transmitter or receiver low voltage or temperature warning is active! In this case you must land the model and cease operations without delay.

2.5. Firmware update or SMART-BOX connection

The SMART-BOX is connected to the DATA socket on the back of the transmitter.

Firmware updates for the transmitter RF module can be transferred via the DATA or telemetry interface in conjunction with a PC running Windows XP, Vista or 7. For this you also require the USB interface, Order No. 7168.6, and the adapter lead, Order No. 7168.6A, which are available separately. The programs and files required for this are available from www.graupner.de in the Download area for the corresponding products. See also chapter 4.1.

3. Receiver



3.1 Connections

Plug the servos into the row of sockets on the right-hand end of the receiver. The connector system is polarised; note the small chamfer on one edge. Never use force - the plugs should engage easily and fully. The socket polarity is also marked on the case: brown wire (-), red (+) and orange (signal). The servo sockets of the Graupner-HoTT 2.4 receiver are numbered. The socket marked “- +/B” is intended for the battery. If necessary, a servo can be connected to this socket in parallel with the power supply; a Y-lead (Order No. 3936.11) is required for this.

It is also possible to program the channel 8 for the sum signal using a Graupner HoTT transmitter or the SMART-BOX (Order No. 33700). This is important for certain optional devices which require this signal.

Power supply for receiver 33508, 33512

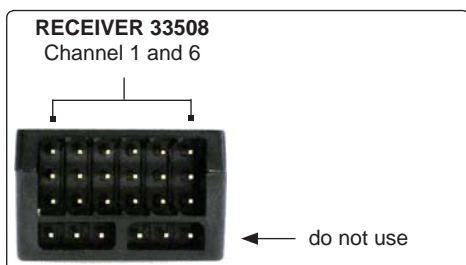
When using High Power servos, connect the receiver power supply/s preferably to the vertical ports of the receiver. If necessary, the servos can be connected to this sockets in parallel with the power supply; a Y-lead (Order No. 3936.11) is required for this.

The lower sockets (33508 and 33512) should not be used, because an increased voltage drop occurs.

When using a dual power supply, use the sockets on the outside:

Receiver 33506/33508 (GR-12/GR-16): Channel 1 and 6 (or 2 and 5)

Receiver 33512 (GR-24): Channel 11 and 12



The socket marked “T” - telemetry interface - on the left-hand end of the receiver is intended for the optional telemetry sensors. This socket is also used for loading firmware updates in conjunction with the USB interface. This socket is also polarised; note the small chamfer on one edge. Never use force - the plugs should engage easily and fully. The socket polarity is also marked on the case: brown wire (-), red (+) and orange (T).

3.2. Low voltage warning

If the receiver voltage falls below 3.8 V, the transmitter's RF module generates a low voltage warning in the form of a "general alarm sound": a steady beeping at intervals of about one second.

Note: The warning threshold can be programmed in the TELEMETRY menu of the transmitter (or with the SMART-BOX). Please read the manual of your transmitter.

3.3. Temperature warning

If the receiver temperature falls below -10° C or exceeds +70° C, the transmitter's RF module generates a temperature warning in the form of a "general alarm sound": a steady beeping at intervals of about one second.

Note: The warning threshold can be programmed in the TELEMETRY menu of the transmitter (or with the SMART-BOX). Please read the manual of your transmitter.

3.4. Firmware updates

Firmware updates for the receiver can be transferred via the programming socket via the programming socket on the side of the unit, in conjunction with a PC running Windows XP, Vista or 7. For this you also require the USB interface, Order No. 7168.6, and the adapter lead, Order No. 7168.6A, which are available separately.

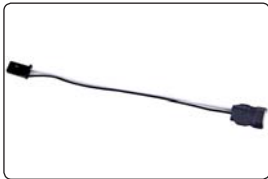
The programs and files required for this are available from www.graupner.de in the Download area for the corresponding products.

See also chapter 4.2.

4. Firmware update Graupner-HoTT 2.4 Transmitter and receiver

Firmware updates for the transmitter RF module can be transferred via the DATA or telemetry interface in conjunction with a PC running Windows XP, Vista or 7. For this you also require the USB interface, Order No. 7168.6, and the adapter lead, Order No. 7168.6A or 7168.6S, which are available separately. The programs and files required for this are available from www.graupner.de in the Download area for the corresponding products.

Install the Firmware Update Utility Graupner and the USB drivers on your computer. Check the system requirements!



This socket is polarised; note the small chamfer on one edge. Never use force - the plug should engage easily and fully.

4.1. Receiver



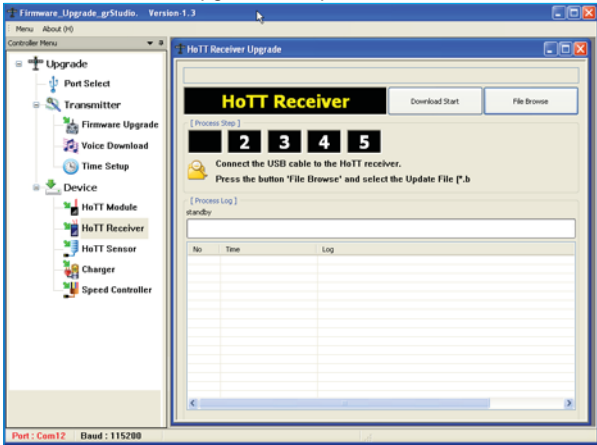
Connect the adapter lead to the socket on the left-hand end of the receiver, as shown in the illustration. This socket is also polarised; note the small chamfer on one edge. Never use force - the plug should engage easily and fully.

The black wire (-) must be at the front, the white wire (T) at the back.

4.2. Update procedure

Ensure that the adapter lead is configured as shown in the illustrations, and is connected correctly to the transmitter or receiver.

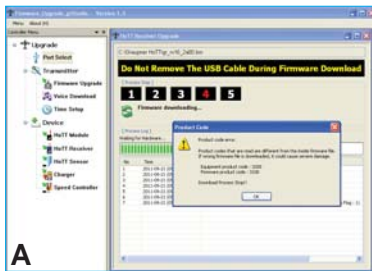
Start the Firmware Upgrade Graupner Studio.



Under „Port Select“ select the correct COM port „Silicon Labs CP210x USB to UART Bridge“, i.e. the one to which the USB lead is connected.

Choose the „HoTT receiver update“ menu. Now click on the “File Browse” button and select the the previously loaded firmware file ending in *.bin. If everything is correct, the file will appear in the corresponding window.

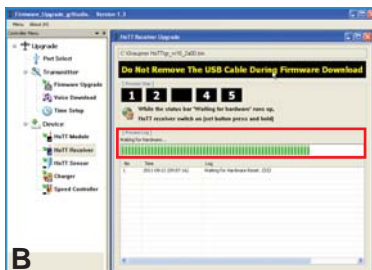
The firmware files are encoded in product-specific form, i.e. if you accidentally select a file which does not match the product (e.g. transmitter update file instead of receiver file), then the pop-up window “Product code error” will appear, and you will not be able to start the update procedure (fig. A).



Press the "Program" button in the software. Wait briefly until you see movement in the progress bar. This may take up to five seconds, depending on the computer (fig. B).

Receiver: press the SET button, and switch the receiver on while you hold it pressed in.

After a few seconds the Status screen displays the message "Found target device..."; you can now release the button, and the firmware update process commences.



If the device is not recognised, if the pop-up window "Target device ID not found" appears, or if the process fails before 100% is reached, you must restart the update procedure. Repeat all the steps as described above.

The Status display and the Progress bar show the progress of the firmware update. The update is completed when the popup message "Download Process Complete" appears (fig. C).

During the update process both red and green LEDs on the receiver glow constantly. When it is complete, the red LED starts flashing, the green goes out.



Switch your receiver off, and disconnect the adapter lead.

Caution: after completing an update process, you must initialise the device before using it, i.e. reset it to the factory default values.

Initialisation:

Press and hold the SET button on the receiver and switch it on, the red and green LED's are blinking. After about three seconds the LED's expires, then only the red LED flashes. Release now the SET button, the initialization is complete.

Please note:

The initialisation procedure erases ALL the settings you have entered. Where necessary, you will need to program your preferred settings again.

Any settings you have entered using the SMART-BOX are also lost when you initialise the receiver. If you carry out a receiver firmware update, you will need to re-enter these settings.

**Konformitätserklärung gemäß dem Gesetz über Funkanlagen und
Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)**
Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment
Act (FTEG) and Directive 1999/5/EG (R&TTE)

Graupner GmbH & Co. KG
Henriettenstraße 94-96
D-73230 Kirchheim/Teck

erklärt, dass das Produkt:
declares that the product

**mx-12 HoTT - No. 33112, mx-16 HoTT - No. 33116,
mx-20 HoTT - No. 33124,
GR-12 HoTT - No. 33506, GR-16 HoTT - No. 33508,
GR-24 HoTT - No. 33512**

Geräteklasse:
Equipment class

2

den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des
FTEG (Artikel 3 der R&TTE) entspricht.
complies with the essential requirements of § 3 and the other relevant provisions of the FTEG (Article 3 of the
R&TTE Directive).

Angewendete harmonisierte Normen:
Harmonised standards applied

EN 60950:2006

Gesundheit und Sicherheit gemäß § 3 (1) 1. (Artikel 3 (1)a)
Health and safety requirements pursuant to § 3 (1) 1. (Article 3 (1) a)

**EN 301 489-1 V1.7.1
EN 301 489-3 V1.4.1**

Schutzanforderungen in Bezug auf elektromagnetische
Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))
Protection requirement concernig electromagnetic compatibility
§ 3 (1) 2, Artikel 3 (1) b))

EN 300 328 V1.7.1

Maßnahmen zur effizienten Nutzung des Frequenzspektrums
§ 3 (2) (Artikel 3 (2))
Measures for the efficient use of the radio frequency spectrum
§ 3 (2) (Article 3 (2))



Kirchheim, 19. Dezember 2011

Stefan Graupner, Geschäftsführer
Stefan Graupner, Managing Director

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Tel: 07021/722-0 Fax: 07021/722-188 Email: info@graupner.de

FCC INFORMATION

Graupner GR-16 HoTT #33508 and GR-24 #33512

FCC ID: ZKZ-33508 and ZKZ-33512

FCC Label Compliance Statement

This device complies with Part 15C of the FCC Rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

WARNING:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15C of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

RF Exposure Statement

This device has been evaluated to meet the FCC RF exposure requirement when used in combination with the genuine Graupner HoTT accessoires and operated with a minimum distance of 20 cm between the antenna and your body.

ENVIRONNEMENTAL PROTECTION NOTES



When this product comes to the end of its useful life, you must not dispose of it in the ordinary domestic waste. The correct method of disposal is to take it to your local collection point for recycling electrical and electronic equipment. The symbol shown here, which may be found on the product itself, in the operating instructions or on the packaging, indicates that this is the case.

Individual markings indicate which materials can be recycled and re-used. You can make an important contribution to the protection of our common environment by re-using the product, recycling the basic materials or recycling redundant equipment in other ways.

Remove batteries from your device and dispose of them at your local collection point for batteries.

In case of R/C models, you have to remove electronic parts like servos, receiver, or speed controller from the product in question, and these parts must be disposed of with a corresponding collection point for electrical scrap.

If you don't know the location of your nearest disposal centre, please enquire at your local council office.

ACCESSORIES:



Order No. 33505 Receiver GR-12S HoTT



Order No. 33506 Receiver GR-12 HoTT



Order No. 33508 Receiver GR-16 HoTT



Order No. 33512 Receiver GR-24 HoTT

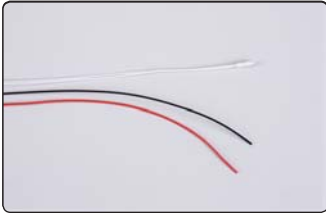


Order No. 33600 Graupner HoTT GPS/Vario
Module

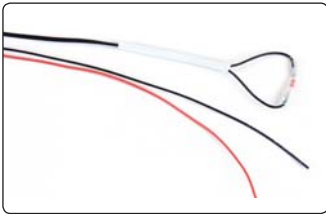
ACCESSORIES:



Order No. 33611 General Air-Module Graupner HoTT Vario, RPM, Fuel, 2x temperature, 2x voltage, max. current 40A, capacity, single cell voltage 2 -6 S



Order No. 33612 Graupner HoTT Temperature Sensor 120°C, voltage sensor



Order No. 33613 Graupner HoTT Temperature Sensor 200°C, voltage sensor



Order No. 33615 Graupner HoTT RPM Optical Sensor



Order No. 33700 HoTT SMART BOX




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www.graupner.de

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Altura Zenith

Control & Functions

Payload options


Aircraft performance

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Explore the Altura Zenith

Unprecedented quality



Altura Zenith

Fly tomorrow's innovation today



Flight-time up to
45 minutes



Payload up to
2.9 kg



GPS assisted
flights



Winds up to
14 m/s



Integrated
fail-safe system

Design, beyond the cutting edge

The Altura Zenith sets a precedent for the design of unmanned aircraft system, by combining state of the art technology with remarkably flat, compact and lightweight design. Starting from scratch enabled us to develop a multirotor aircraft system that can meet a wide variety of application requirements without compromise.

Unrivaled performance

Performance and beauty are the cornerstones of the Altura Zenith. The structure was designed to enclose electrical components of the highest quality in a streamlined manner. Hidden within a super flat design, the Zenith carries a 20.000 mAh battery, which facilitates up to 45 minutes of flight-time with total payloads of up to 2.9kg.



Altura Cardan adaptor

A unique patented payload adaptor



Integrated vibration isolator

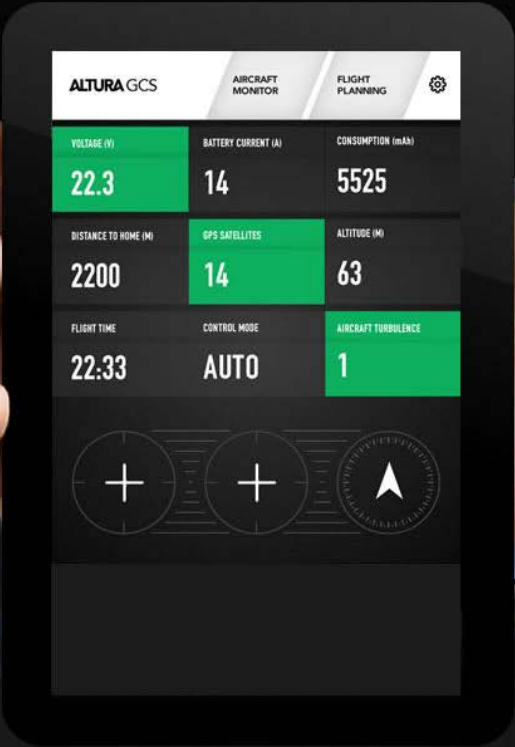


Quick release payload / gimbal adaptor

Easy to operate

Everyone can fly the Zenith

> Explore all control features



Easy to operate

The Zenith can be operated by tablet and RF joystick. The intuitive tablet control interface is designed to facilitate swift and easy learning whilst the RF joystick enables stabilized precision flights. Convenience is key!

[Learn more](#)



Safety first

The Altura Zenith was designed according to aviation grade standards to ensure the highest levels of safety. Each Zenith is thoroughly flight tested and equipped with several fail-safes to avoid incidents or danger. Safety is guaranteed by Zenith.

[Learn more](#)

Advanced propulsion system
Customized optimization of flight-time and payload



The Aerialtronics in-house research team has spent over 6500 man-hours developing and optimizing the propulsion system of the Altura Zenith. The Zenith is equipped with 4 or 8 brushless motors to enable optimal torque, rpm and energy efficiency ratios. The brushless motors combined with efficient 16" propellers exert over 16kg of vertical thrust. However, there is no need to question safety. A general flight with recommended payload is flown at approximately 30 to 40 percent of maximum power. So, there is plenty of room for expansion.



High-performance batteries

Integration of the latest high performance and high capacity batteries of up to 20 Ah, makes the Zenith more compact, yet equally efficient.

[Aircraft performance](#)

Flight-time up to 45min

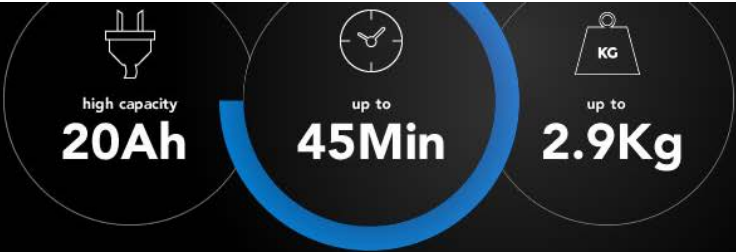
The modular setup enables customized optimization of payload and flight time facilitating up to 45 minutes of flight time.

[Aircraft performance](#)

Payload up to 2.9kg

The onboard propulsion system, facilitates a remarkable payload range up to 2.9kg, which makes it suitable for almost all applications.

[Aircraft performance](#)



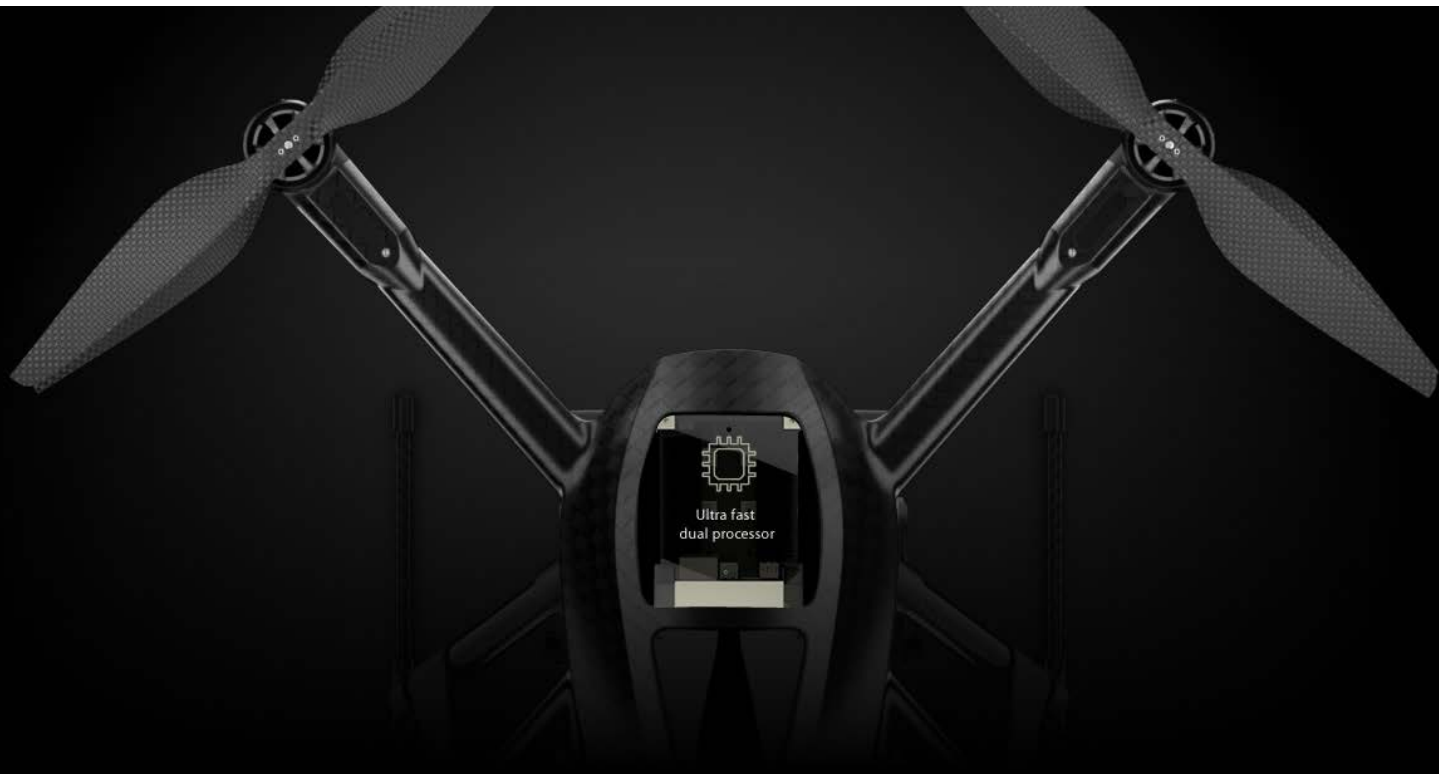
Mastermind

Innovative control

The mind of the Zenith is where the magic happens.

The advanced flight controller ensures effortless, safe and stable flights. The Zenith essentially thinks for you.

The Zenith allows you to focus on obtaining the information you require whilst it manages your flight for you.



The efficiency of 4, the power of 8
Explore the Zenith family

[▶ Compare aircrafts](#)



Product Gallery



Altura Zenith right



Altura Zenith left



Altura Zenith back



Altura Zenith front

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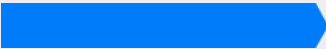
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Simplicity facilitates easy control

Everyone can fly the Zenith

Altura Ground Control

Control without limitations



Joystick RF control

The Joystick RF control module enables full manual or GPS assisted control. Pilots can adjust the flight direction, payload or camera angles from the ground, according to their specific requirements.



Tablet control

The touchscreen tablet control has a simple, intuitive user interface, which enables easy navigation and flight information. Automated "take-off" and flight programming are within one touch reach.

Simplifies flight



Aircraft telemetry & status

The Altura GCS app provides you a detailed overview of the aircraft status such as location, battery status and GPS.



Automate with waypoints

Fly autonomously along pre-defined flight paths and independently gather the required data.



Dog mode / Follow me

The Altura Zenith autonomously follows and films you by carrying our GPS enabled GCS tablet.



Auto take-off & landing

Do not worry about take-off and landing. It is now possible to start, take-off and land the Zenith by a flick of a switch.

Photogrammetry & mapping

Heading lock

This mode will cause the Zenith to

Virtual fence & safe zones

The Zenith can be flown within its

Aircraft configuration

The Altura GCS app enables you to



Easily pre-define flight grids, after launching the Zenith, the software takes control, navigates and takes pictures according to the grid.

remember which direction is "forward" so you don't have to worry about the aircraft heading during flight.

virtual shelter of which it can't leave the virtual pre-defined flight radius or maximum height.

adjust functions such as: payload settings, cruise-speed, max-height and flight distance.

Joystick RF control

For those who requires precise handling.



Manual control

Pilots can manually adjust the flight

GPS assisted flights

The pre-programmed switches allows

Aircraft telemetry & status

The RF controller is provided with an

Payload or camera control

Pilots can remotely adjust the payload



direction, height, cruise-speed and have full control on all payload features from the ground.

the pilot to switch between various flight-modes, such as: GPS/Altitude hold, coming home and landing.

build-in LCD status monitor, which provides you with the most important aircraft status information.

tilt and panning angle and have full control on all payload features from the ground at the same time.



Dual operation

Focus on flight as well as payload



In the dual operation mode the system is configured with a second control unit to facilitate a focus on both the flight as well as the payload configuration. This allows the users to perform safe and steady flights whilst delivering optimal data or imagery.

Analyze in realtime

The Zenith provides you a cristal clear live-view image



Live view

The live HD downlink provides real-time access to the Zenith's video feed via HD or SD monitor. This feature enables the operator on the ground to see what the camera is recording in the sky. [more...](#)

Upgrade to HD quality

The Zenith comes standard with an SD quality (analog)video-link, for high-end broadcast purposes, you can upgrade the video transmitter to HD encrypted quality. [more...](#)

Up to 1km range

The Altura Envair HD video transmitter provides a unique Full HD 1080i – H.264 encrypted video feed with as little as 20ms latency and a range of up to 1 km. [more...](#)

Ground control station
From standard to premium



Product gallery



Ground control station standard



Ground control station premium



Camera controller standard



Camera controller premium

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Aircraft performance

Altura Zenith ATX4

The endurance winner



Payload ATX4



Take-off weight
4.6 kg



Max payload ATX4
1.4 kg

Flight-time graph ATX4



Max flight time
45 minutes



Battery
22.2V - 16.600 mAh

Altura Zenith ATX8

A true heavy lifter



Payload ATX8



Take-off weight
5.6 kg



Max payload ATX8
2.9 kg

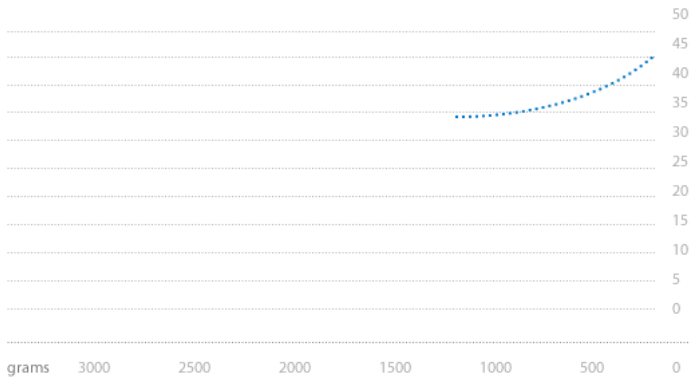
Flight-time graph ATX8



Max flight time
35 minutes



Battery
22.2V - 16.600 mAh



Weather conditions ATX4



Max wind speed
Up to 9 m/s



Weather
Dry to light rain or snowfall

Flight performance ATX4



Max cruise speed
20 m/s



Average cruise speed
5 m/s (adjustable)

Aircraft dimensions

Length x Width
600 x 600 mm

Height
350 - 550 mm

MTOW ATX4
6.0 kg

MTOW ATX8
8.5 kg



Joystick controller

Controller frequency
2.4 Ghz

Telemetry frequency
Variable

Range
1000 m

Video frequency analog Video frequency digital



Weather conditions ATX8



Max wind speed
Up to 14 m/s



Weather
Dry to light rain or snow

Flight performance ATX8



Max cruise speed
20 m/s



Average cruise speed
5 m/s (adjustable)



Tablet controller

Controller frequency
2.4 Ghz

Telemetry frequency
Variable

Range
1000 m

Video frequency analog Video frequency digital

5.8 Ghz	2.1 - 2.9 Ghz	5.8 Ghz	2.1 - 2.9 Ghz
Control functions		Control functions	
12 Channel manual RF control		Auto take-off and landing	
GPS / Altitude Hold		Auto go home and landing	
Auto go home and landing		GPS waypoint navigation	
Camera angle control		Direction lock (carefree)	
Camera shutter and zoom		Camera point of interest	
Multiple camera switching		GIS mapping	
Automatic fail-safe system (signal loss)			
Telemetry (data display)		Telemetry (data display)	
Battery voltage (V)		Battery voltage (V)	
Battery usage (mAh)		Altitude & Distance (meters)	
Range / Signal status		GPS Longitude/Latitude coordinates	
		Number of GPS satellites	
		Flight-time (min)	
		Flight mode	
		System state	
		Joystick display	
		Battery usage (mAh)	

Aircraft system overview



Airworthiness approvals

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UNMANNED AERIAL VEHICLE (UAV) PORTFOLIO

Autonomous aircraft flown from remote locations

UAV classification: Vertical Take Off and Landing (VTOL)

cyberQuad

THE ULTIMATE RAPID RESPONSE
HOVERING URBAN AERIAL VEHICLE



A unique amalgamation of state-of-the-art VTOL UAV technologies, CyberQuads combine the mechanical simplicity, low noise, stability and agility of a quadrotor with the compactness,

safety and efficiency of ducted fans. With only four moving parts that are safely shrouded, CyberQuads are low maintenance, easily transportable and rapidly deployable.

EXPERIENCE MORE COMPACT PERFORMANCE

- Easily fly through doorways, down hallways and through tight spaces without risking a rotor strike.

DEPLOY IN LESS THAN ONE MINUTE

- Only four moving parts with no assembly required.

EXECUTE YOUR OPERATION IN STEALTH

- Less than 65 dBA at 3 meters and inaudible beyond 30 meters.

FLY AUTONOMOUSLY

- Way Point Navigation, auto-take-off and the Ground Control Station provide fully autonomous flight.

RECORD VIDEO AIRBORNE WITH EXCEPTIONAL CLARITY

- With the optional onboard video recorder or HD camera payloads, the video is recorded in high resolution onboard and utilises transmission noise-free post processing.

SAVE MONEY

- Each battery costs less than \$0.01 to charge. A complete CyberQuad solution typically pays for itself in less than 10 hours of conventional helicopter use.

AVOID RISK WITH A SAFE DESIGN

- CyberQuads utilise electric propulsion which avoids engine fumes, fuel and heat.

CUSTOMIZE YOUR PAYLOAD TO SUIT YOUR OPERATION



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**CYBERQUAD IS
AVAILABLE
IN TWO SIZES.**



**CYBERQUAD
MINI**



**CYBERQUAD
MAXI**

SPECIFICATIONS	CYBERQUAD MINI	CYBERQUAD MAXI
Endurance	25min	35min
Payload	500g	800g
Airspeed	50 km/h	60 km/h
Altitude	1 km (video link)	1 km (video link)
Range	1 km (video link)	1 km (video link)
Noise	65dBA @ 3m	70dBA @ 3m

LEVEL OF AUTONOMY	DESCRIPTION
Semi-autonomous	GPS and compass aided position and heading hold <ul style="list-style-type: none"> Keeps the CyberQuad in position, compensating for wind Remembers home position and can return automatically
Fully-autonomous	Way Point Navigation <ul style="list-style-type: none"> The Ground Control Station with aerial map interface allows the pilot to control the UAV via programmed Way Points Auto-take-off and landing.



CyberQuad Box

Optional extras include Hand Held Video Recorder, Wrist Mount Video Recorder, DVD Recorder, MiniDV Recorder Display, Ruggedized Laptop, COFDM Digital Video Link. Payload options include Onboard Capture Camera, Combined Thermal/Optical Camera, Onboard Analogue Video Recorder, On Screen Display, AirGuard chemical & gas detection system. Customised payloads can be developed to meet specific needs.

APPLICATIONS

- Security & Surveillance
- Military
- Emergency Services
- Search and Rescue
- Infrastructure Inspection
- Environmental Conservation
- Agricultural Operations
- Real Estate
- Film Production & Photography

To view the CyberQuad in action www.cybertechuav.com.au

en/MC-20

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1 Info

Important

If you use the latest Graupner software on your transmitter and receiver, you have to **switch off** the FAIL SAFE in the receiver !!!

If you do not switch off the FAIL SAFE the copter can not note the "signal lost" if the connection is broken !!!

Switching off goes like this:

- Switch ON the transmitter and receiver
- Push and hold the button **ESC** - the menu Menü **Telemetry** opens
- Down to **SETTING & DATA VIEW** and open with **SET**
- Go right to the menu **RX FAIL SAFE**
- OUTPUT CH und INPUT CH are set to 01
- Down to **MODE** and edit with **SET**
- Change from **HOLD** to **OFF**
- Pres **SET** again and close the menu with ESC

Ready.

If now the transmitter / receiver lost the signal, the copter will note this.
You can test this quick. Switch off the transmitter. Now the copter should beep.

The described settings and procedures are related to the current **V4** from Graupner.

All references to pages of the instruction manual refer to the current manual "33020_mc20_HoTT" ([Link](#)).

A working model memory for the MC-20 and a setting for the FlightCtrl you can find and download under ["Example: Setting - Download"](#).

See also: [HoTT-Update](#)

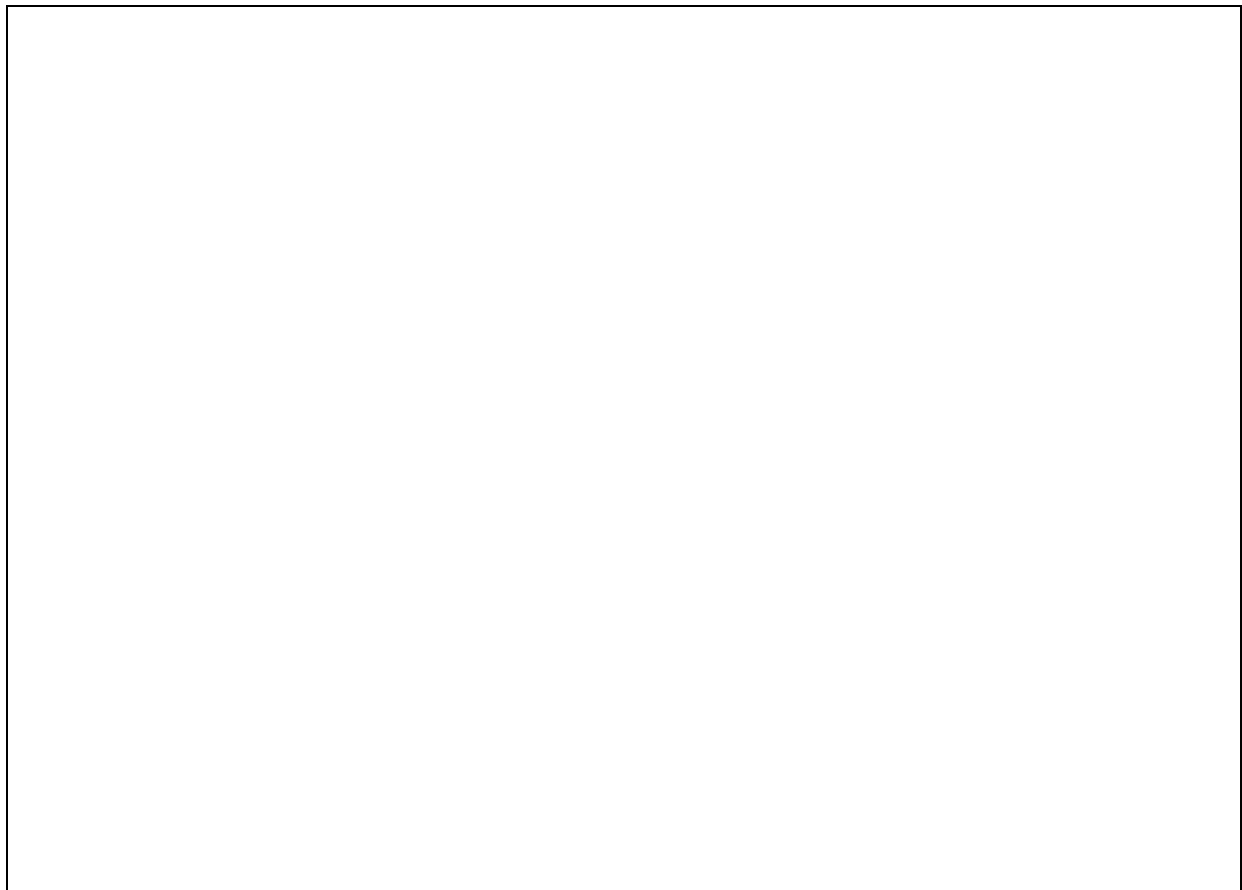
2 Graupner MC-20 HoTT

Shoplink: [Graupner MC-20 HoTT](#)

The MC-20 HoTT is an ideal transmitter for the MikroKopter. With its function you are able to use all 12 channels of the FlightCtrl.

The data:

- 12 channels for switches, buttons and pots
- 2,4GHz transfer technology
- Graupner indicates a range of about 3km (with receiver GR-16 or GR-24)
- Bidirectional communication between transmitter and receiver
- Display of the MikroKopter-Telemetry on the built-in and illuminated 8x21 character LCD
- Language edition of the telemetry values (via connected loudspeaker or head-set)
- 12 switches (3 three-way switches, 5 two-way switches, 2 pushbutton, 2 two-way switches with lock)
- 2 INC/DEC-switches
- 4 analog Pots
- Built-in DSC-socket for the connection of flight simulators ([AeroSim](#)) or a [TrainerMode](#)
- More than 200 systems can be used simultaneously -> No agreements on channels like 2 or 3 years ago
- Future-proofed with update capability via USB Interface ([HoTT-Update](#))
- Different menu-languages for the transmitter (i.e. Dutch, English, French, German, Italian, Spanish)





Graupner MC-20 HoTT

INFO:

The HoTT-Telemetry is supported from **FlightControl V2.1**.

NEW: Support of the Graupner **V4** version.

The needed software for the Graupner transmitter/receiver and the needed voice file you can download here: [Download](#)

Now with the **V4** you can display the telemetry data in a new menu. The display in the text-telemetry is also still possible.

In addition customized voice messages can be played to the same time.

That is possible since the following software versions:

- At the Kopter:
FlightCtrl V 0.88m + NaviCtrl V 0.28m ([Link](#))

Graupner transmitter/receiver:

Transmitter MC-20 HoTT (V4) V 1.016

Receiver GR-16 V 5a70 / GR-24 V 3a40

Soundfiles => Dutch, English, French, German, Italian, Spanish

2.1 Instruction for the MC-20

The instruction of the appropriate and actual version you can download directly from Graupner: [MC-20 HoTT Instruction Manual](#)

3 Configure the transmitter + bind receiver

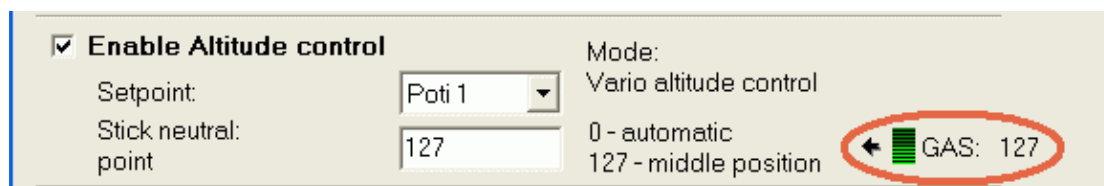
3.1 Spring in the transmitter

By default there is a spring at the gas stick which keeps it always in the center position.

Normally this spring of the gas-stick is without function to move the stick infinitely variable. (Instruction of the transmitter - page 21)

If you have already a little bit experience and if you want to fly with vario-height control all the time, you don't need to remove the spring.

If you leave the spring in function so that the Gas-Stick is always in a middle-position you need to enter in the setting ([Link](#)) at "Stick neutral point" the middle-position => 127:



The screenshot shows a settings menu for altitude control. On the left, there is a checked checkbox labeled "Enable Altitude control". Below it, "Setpoint:" is set to "Poti 1" and "Stick neutral point:" is set to "127". On the right, "Mode:" is set to "Vario altitude control". Below the mode, it lists "0 - automatic" and "127 - middle position". To the right of these options is a green bar with a left-pointing arrow and the text "GAS: 127", which is circled in red.

3.2 Set Stick Mode

The easiest way (also for beginners) is to fly the MikroKopter in **Mode2**.

Here you have the function "Gas" and "Yaw" on the left control stick, "Nick" and "Roll" on the right control stick.

(Instruction of the transmitter - page 84)

If you fly a different mode over years you can also use it here.

The stick arrangement for the different modes (1-4) and how the various functions of the MikroKopter can be set via the transmitter is described here: [Stick-Setup](#)

Adjust transmitter to Stick-Mode2 (or a different mode):

- In the opening screen of the transmitter you need to press on **SET** to enter the settings.
- With the arrow keys UP/DOWN you choose the entry **Base setup model** and with the key **SET** you open it.
- Here you switch to the entry **Stick mode** and choose it with the **SET** button (The displayed number is now a dark background).
- With the arrow keys you can set now the desired mode (1-4) and save it with "SET".
- Via the button "ESC" you can switch back.



Channel assignment of the control sticks in Mode2:


- Channel 1 = Gas
- Channel 2 = Roll
- Channel 3 = Nick

- Channel 4 = Yaw

3.3 Bind the receiver

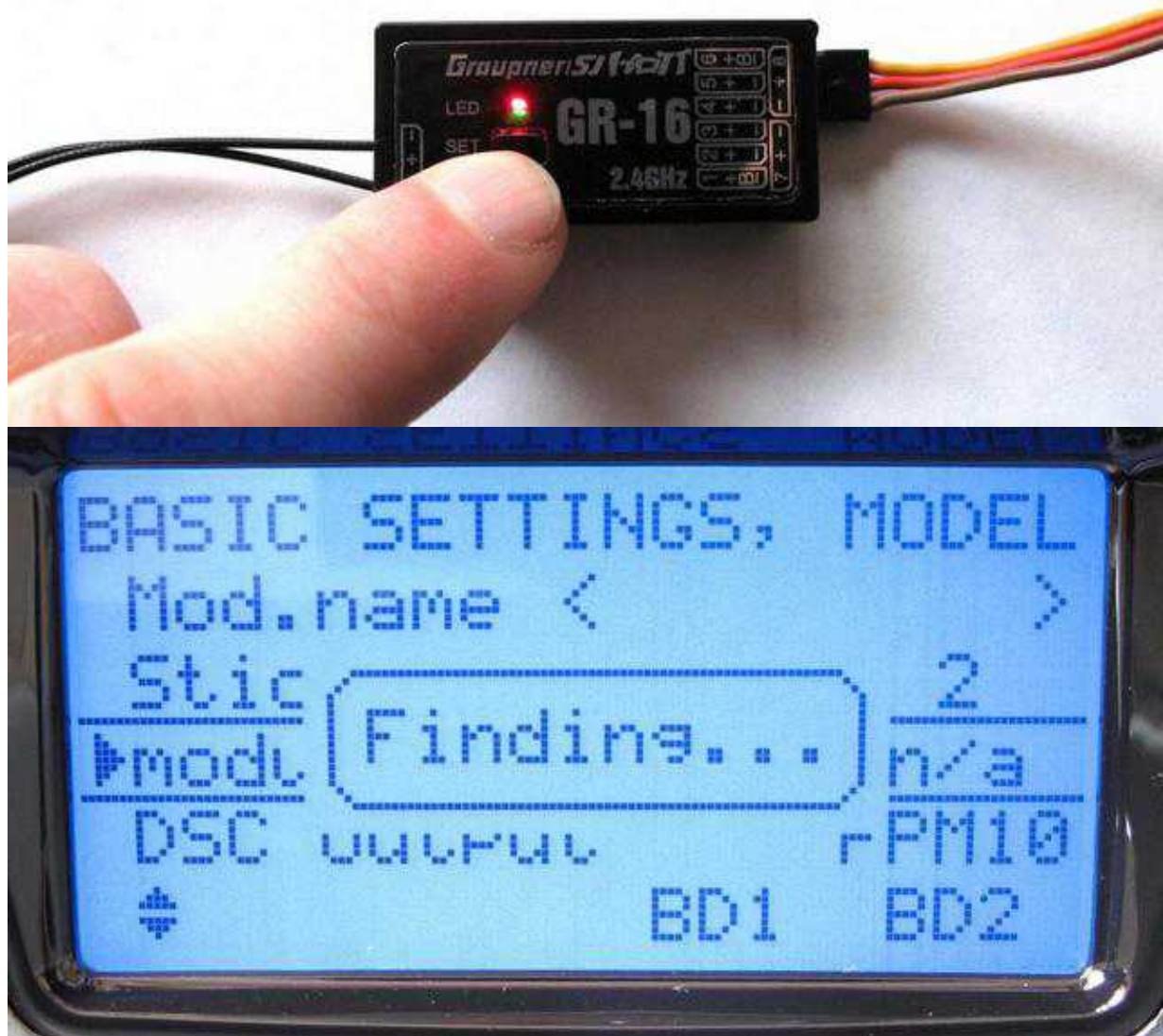
Transmitter and receiver have to be bound together, so that the receiver only reacts to that transmitter.
(Instruction of the transmitter - page 69)

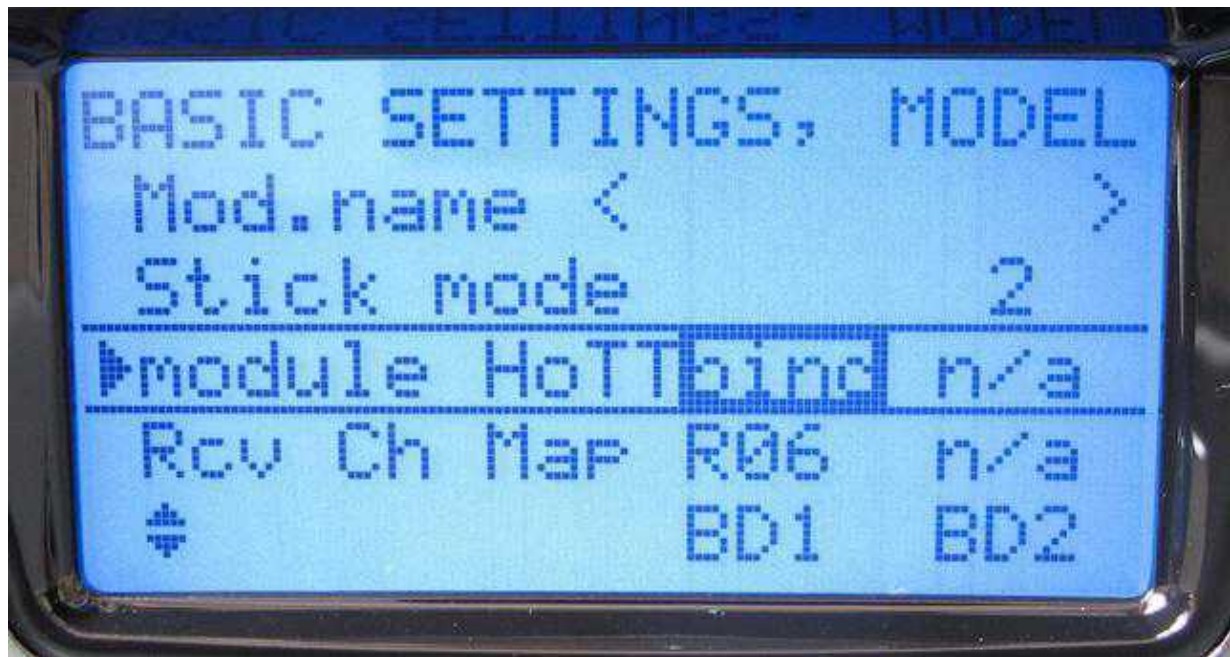
To bind the receiver you do as follows:

- When turning on the transmitter you see the message RF ON / OFF. Choose OFF.
- The receiver has to be supplied with 5V (i.e via 3-core-wire from the FlightCtrl).
- Press "SET" in the opening screen to get into the settings.
- Select "Base setup model" with Up / Down and open it with the button **SET**.
- In that menu pull down with the arrow key to the entry **Base Setup Model**.
 - ♦  Only if there is already a "BIND", press once **SET** to get a "n/v".
- At the receiver now press and hold down the button "SET":
 - ♦ Receiver GR-12 => hold down "SET" button.
 - ♦ Receiver GR-16 => hold down "SET" button until the red and green LEDs light together (maybe difficult to see that clearly).
 - ♦ Receiver GR-24 => hold down "SET" button until the red and green LEDs light together (maybe difficult to see that clearly).
- Press "SET" within 3 seconds at the transmitter (in the row "RF BIND")
- "Finding" appears in the display for a short time.
- "RF BIND [bind]" appears in the display at success and the green LED lights continuously at the receiver.









3.4 Set the receiver to sum-signal

The !Mikrokopter needs a so-called !sum-signal. All channels of the receiver are included in it. This makes the wiring a lot easier compared to normal servo-receivers.

After the receiver has been *bound* to the transmitter you can set the PPM sum-signal:
(Instruction of the transmitter - *CH OUTPUT TYPE* - page 238)

- The receiver has to be supplied with 5V (i.e via 3-core-wire from the FlightCtrl).
- Hold down "ESC" at the transmitter for about 2 seconds -> You get into the menu "Telemetry".
- Select **SETTING & DATA VIEW** and open it via the button **SET**.
- The menu **RX SERVO TEST** will open.
- Switch to the menu "RX SERVO TEST" by pressing "right" 5 times.
 - ◆ INFO: If you have clicked to far and you see the MK-Menu you can remove the 1-core telemetry plug from the FC to get back to the page "RX SERVO TEST".
- In the menu "RX SERVO TEST" you switch to the lower entry **CH OUT TYPE**.
- With the button **SET** you open that entry and you change from "ONCE" to **SUMO** (with the arrow keys UP/DOWN).
- Confirm with SET.
- You get to the data field with the number of channels in the sum-signal. Set this to "12" with Up/Down (for 12 channels).





INFO

If you hold down the button (accidentally) at the receiver while connecting, the "SUMO 12" setting will be deleted. This can also happen if you connect the receiver with a powered up MikroKopter and hold down the button. In this case you have to set this setting again.

INFO

If you don't have a number behind **SUMO** an older software version is installed in the receiver! You have to update the receiver. How to update the receiver you can see here: [Update](#)

3.5 Set servo adjustment

To run the functions on the MikroKopter properly the servo adjustment of the 12 individual channels must reach a range of "0" to "254" (See also later in the [KopterTool](#)).

The servo adjustments at the transmitter are pre-set to 100% for all channels. If you leave it in that way you are not able to reach the full servo adjustment.

For that reason you need to set all servo adjustments to **103%**.

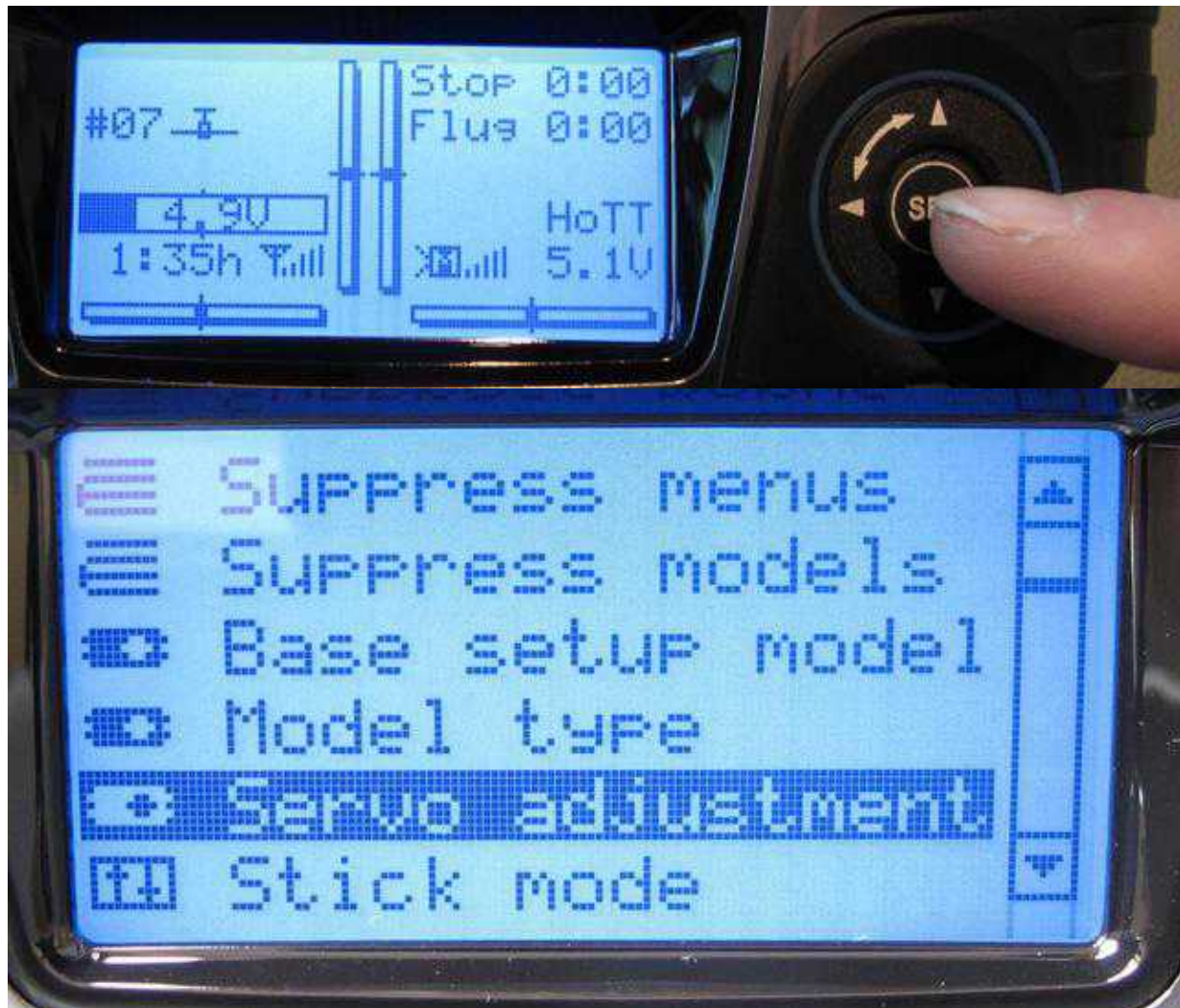
To set the servo adjustments we proceed as follows:

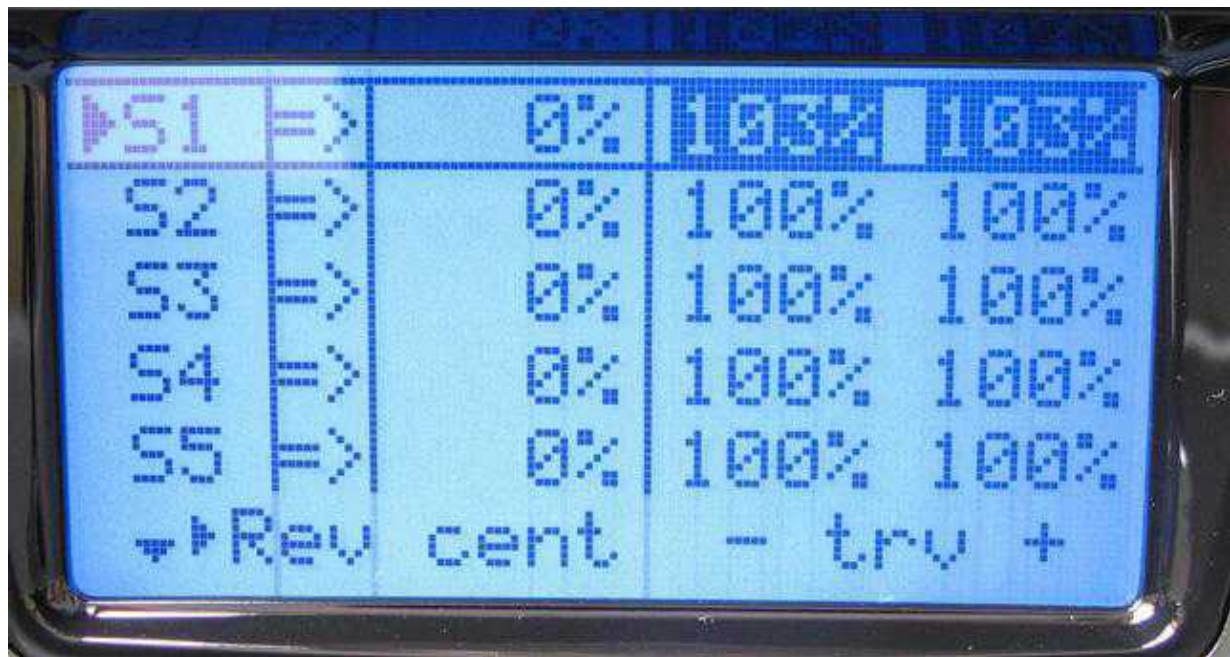
- Press **SET** in the opening screen to get into the settings.
- Select **servo adjustment** with UP/DOWN and open it with **SET**.
- Switch to the channel (S1-S12) which need to be changed. Use the arrow-key to the right on the percentages for "- travel +" and select **SET**.
- (Both percentage values are selected at the same time (dark background))
 - ◆ INFO: If only one percentage value is selected you can toggle/turn through the appropriate switch/potentiometer to the second percentage

- Change the percentage value with UP/DOWN to "103%" and press **SET** to confirm.

In that way you set all 12 channels.

(Instruction of the transmitter - page 90)





3.6 ASSIGN CHANNELS

In your transmitter the first four channels are already assigned to the control sticks for the function *Gas*, *Yaw*, *Nick* und *Roll*.

The remaining channels (5-12) you can assign freely to switches, buttons and potentiometer on your transmitter.

With those channels you can control the functions of the [MikroKopter](#).
(Instruction of the transmitter - page 71)

Before starting with the assignment of the channels you should establish memory for that at your transmitter. This memory need to be created as *Winged Model*. The first memory is usually already set as a *Winged Model* and can be used.

Is that not the case or you need an additional model memory (because you operate more than one Kopter or other models with one transmitter) you can set it as a new *Winged Model*.

Setting of the channels:

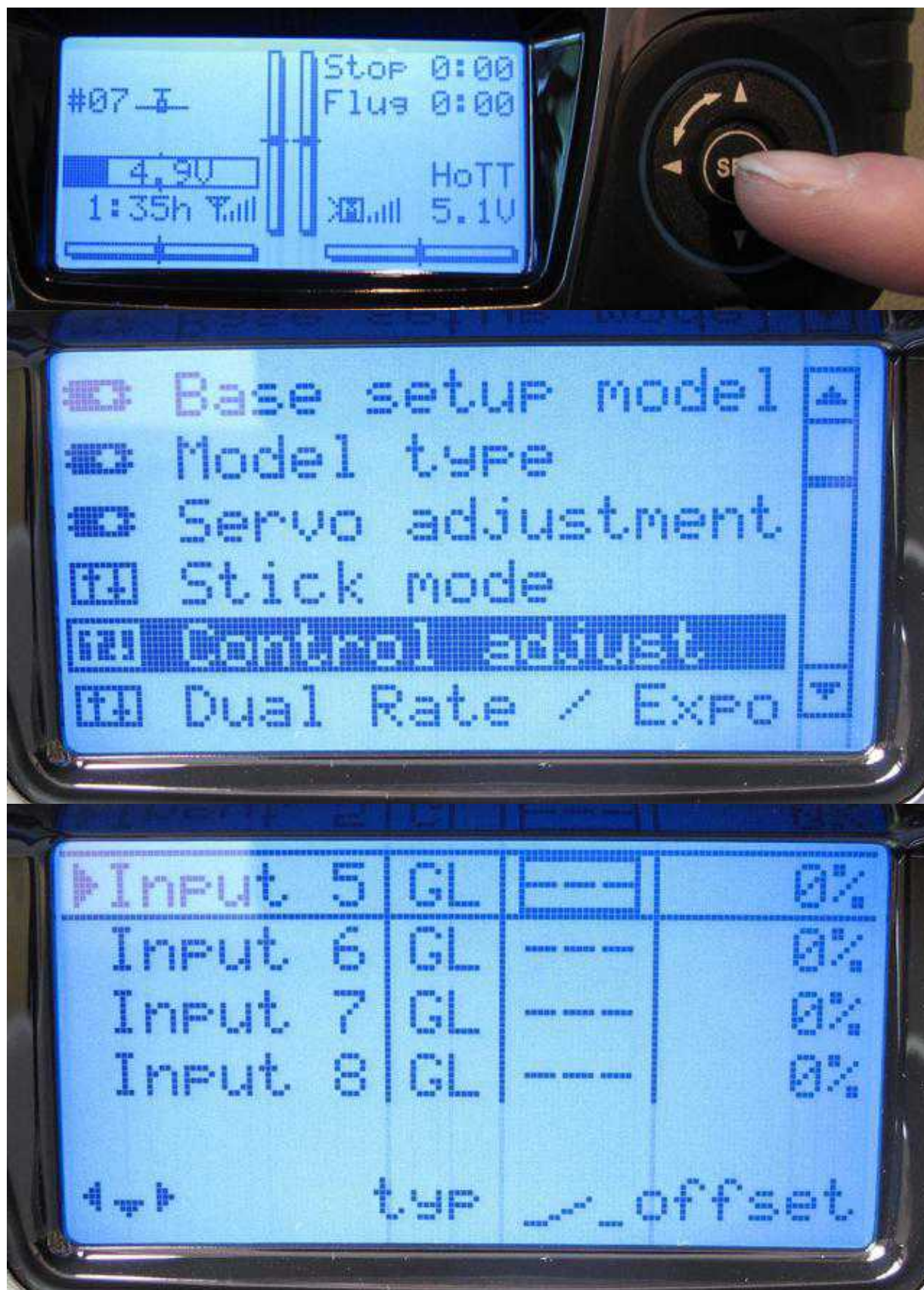
To assign the channels you proceed as follows:

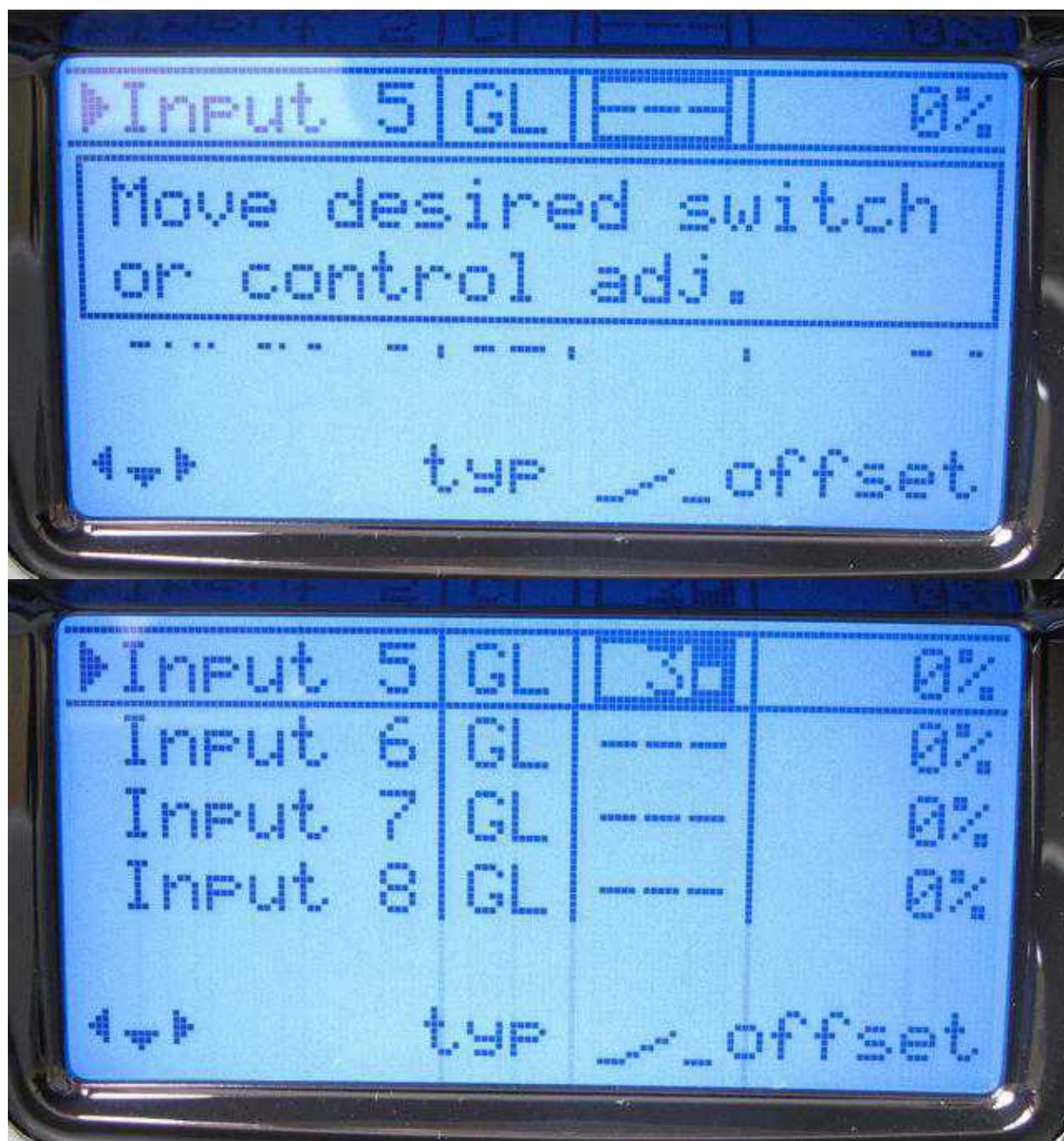
First at all switch all switches to an "OFF"-position (away from you).

- Press **SET** in the opening screen to get into the settings.
- Select **Control adjust** with UP/DOWN and open it with **SET**.
- Choose desired channel with UP/DOWN (i.e. channel 5 => |Input. 5|GL|---| 0%|).
- Here now switch with LEFT/RIGHT to the three bars (---) and push **SET**.
- A display appears "Move desired switch or control adj.".

- Now switch the desired switch (or turn potentiometer).
- Instead of the three bars you will see now the operated switchn.

Repeat now the operations for the remaining channels.





Examples for the channel assignment:

This is an example for the channel assignment. Any other assignment is also possible.
(The first 4 channels for the control are already pre-assigned.)

- Channel 5	(Poti1)	=>	Function altitude hold
- Channel 6	(Poti2)	=>	Function GPS (PositionHold / ComingHome)
- Channel 7	(Poti3)	=>	Free

-	Channel 8	(Poti4)	=>	Function CareFree
-	Channel 9	(Poti5)	=>	Camera tilt (Nick)
-	Channel 10	(Poti6)	=>	Camera tilt (Roll)
-	Channel 11	(Poti7)	=>	Trigger camera & LED on/off
-	Channel 12	(Poti8)	=>	Function Motor Protection

4 Connect receiver

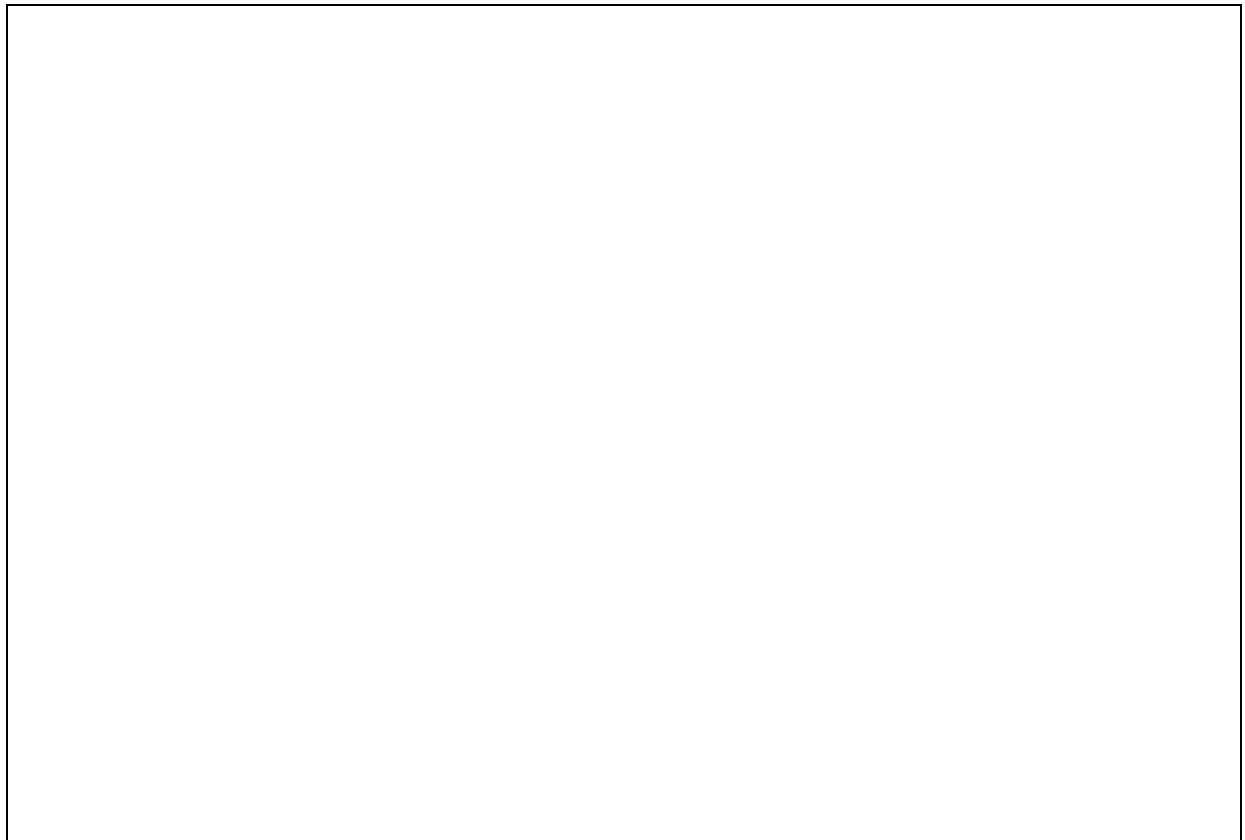
The HoTT-System offeres different receiver which can be used on the MikroKopter.
The connection of the receiver GR-12, GR-16 and GR-24 are described below.
All of the three receiver are able to provide 12 channels via the PPM-Sum-signal.

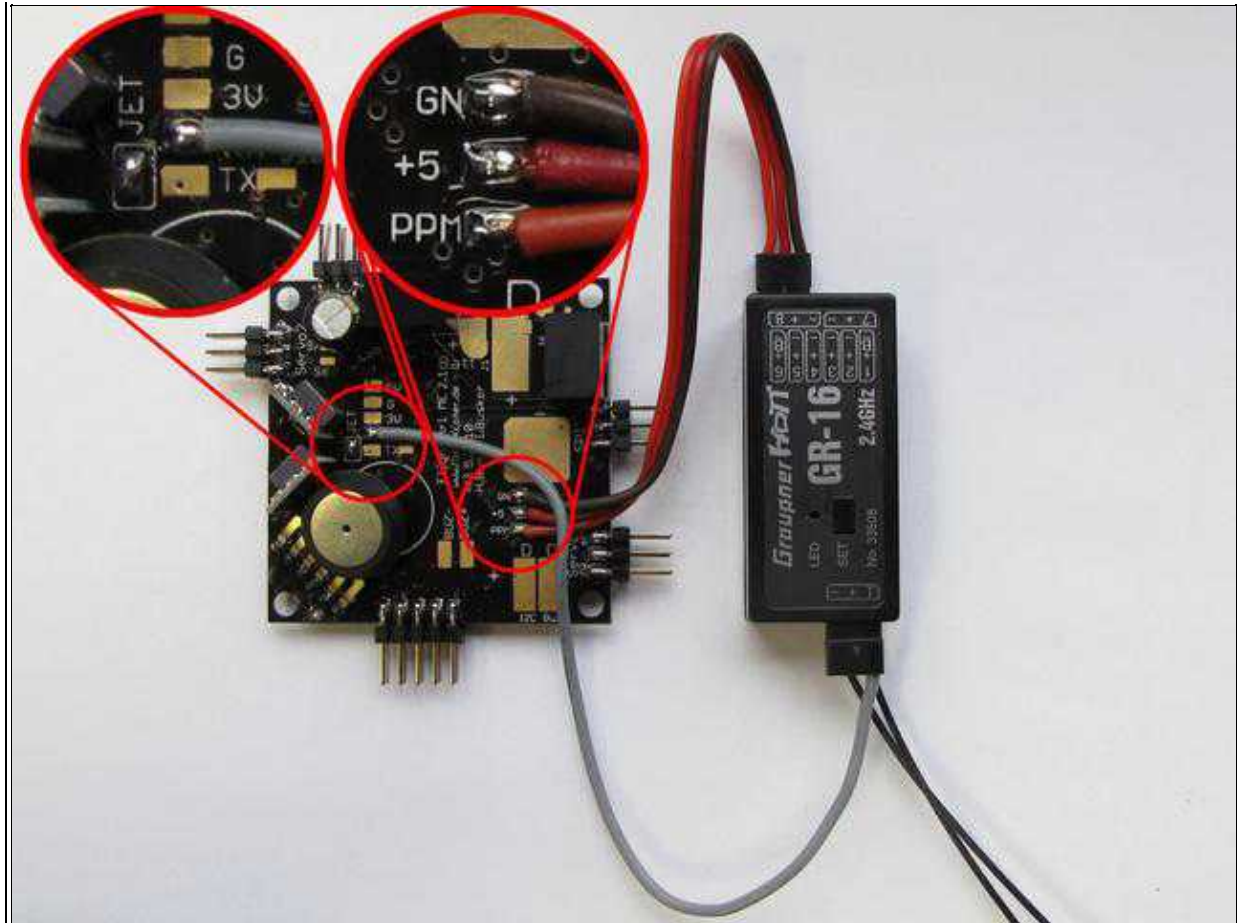
Each receiver need to be connected with a PPM-Connection-cable and a JR-Data-cable (for the telemetry transfer) ([Link](#)) to the FlightCtrl.

4.1 Connection of the receiver to the FlightCtrl2.1

The PPM-cable as well as the JR-Data-cable for the telemetry will be connected to the FlightCtrl as follows:

- PPM-cable - Black on "GND" (Ground/Minus)
- PPM-cable - Red on "+5" (Plus)
- PPM-cable - Orange on "PPM" (PPM-Data-wire)
- +
- Solder JR-Data-cable (for the HoTT-Backchannel) to "RX".
- (Connected will be this cable to the sensor connector labeled with "T" on the HoTT-Receiver.)
- +
- Jumper "JET" on the FlightCtrl has to be bridged.





To enlarge -> click on the image

4.2 Receiver GR-12

The GR-12 HoTT is a 6-channel receiver and is able to provide up to 16 channels throughout the sum-signal (depends on the transmitter).

The range with this receiver is according [Graupner](#): 2000mtr.

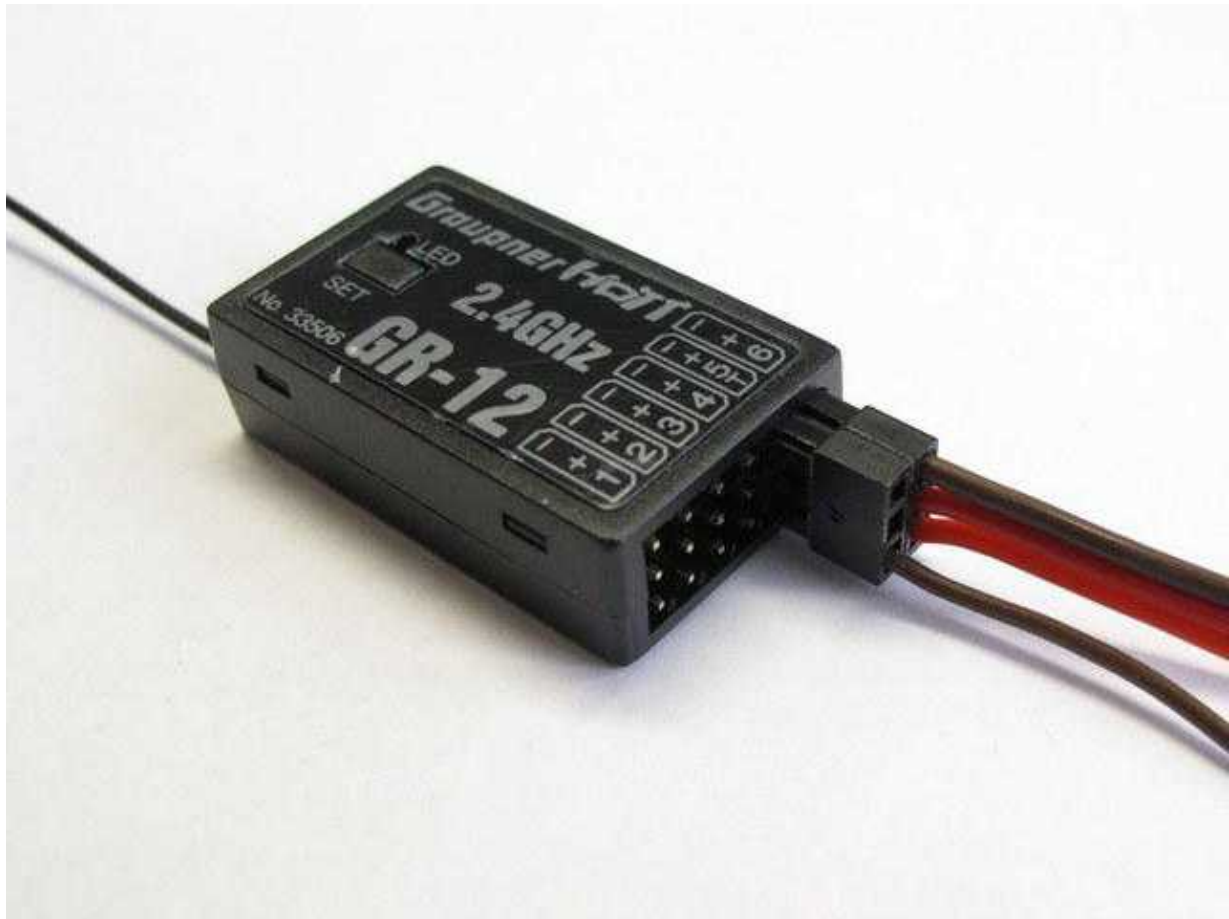
Output for the sum-signal GR-12:



- The receiver has to be bound to the transmitter (see: "Binding").
- The !Sum-Signal must be activated (see: ["Set receiver to sum-signal"](#)).
- The !Sum-signal is on output 6.

Telemetry connection GR-12:

The receiver has a separate data channel at output 5 for the [MikroKopter](#) telemetry:

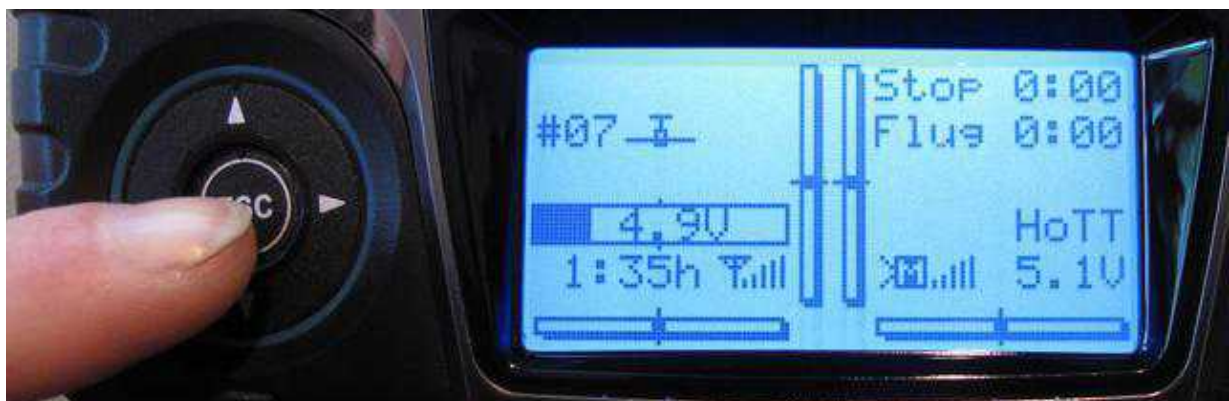


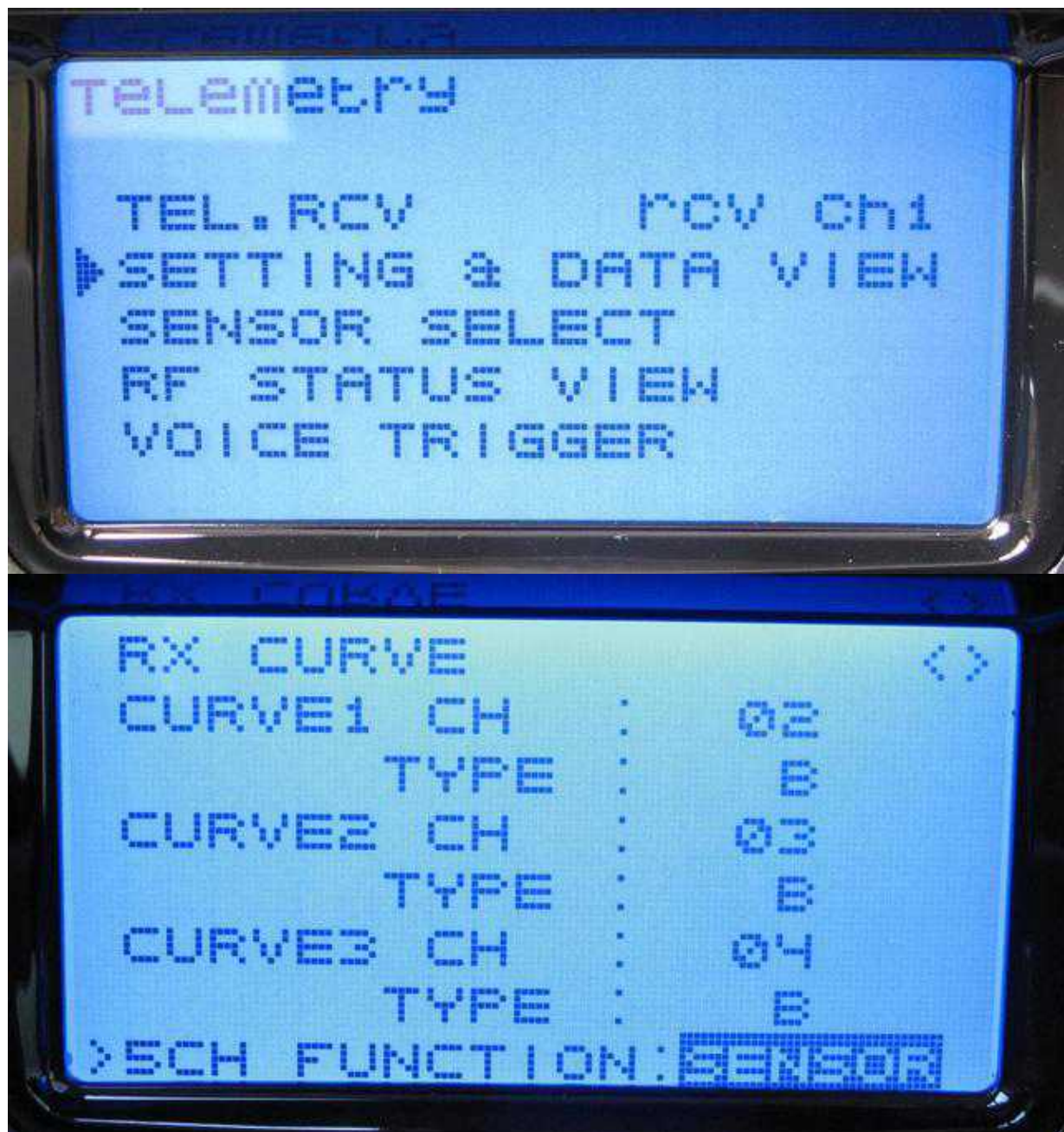
⚠ ATTENTION:

The following setting is only for the receiver GR-12!

To receive the telemetry here you need to change the servo-output 5 first.

- In the opening screen of the transmitter press **ESC** to switch into the telemetry.
- With UP/DOWN choose **Setting & Data View** and open it with **SET**.
- With the arrow-keys LEFT/RIGHT switch to **RX CURVE**.
- Choose **5CH FUNCTION** and change it to **SENSOR**.



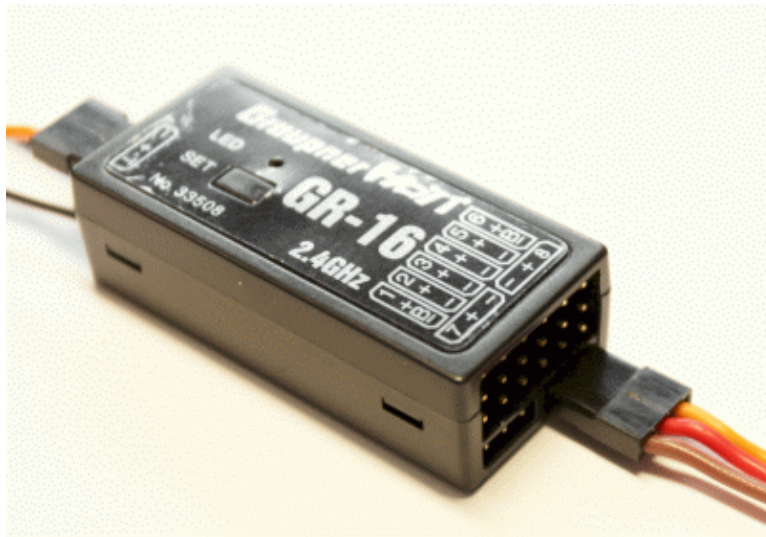


4.3 Receiver GR-16

The GR-12 HoTT is a 8-channel receiver and is able to provide up to 16 channels throughout the sum-signal (depends on the transmitter).

The range with this receiver is according [Graupner](#): 4000mtr.

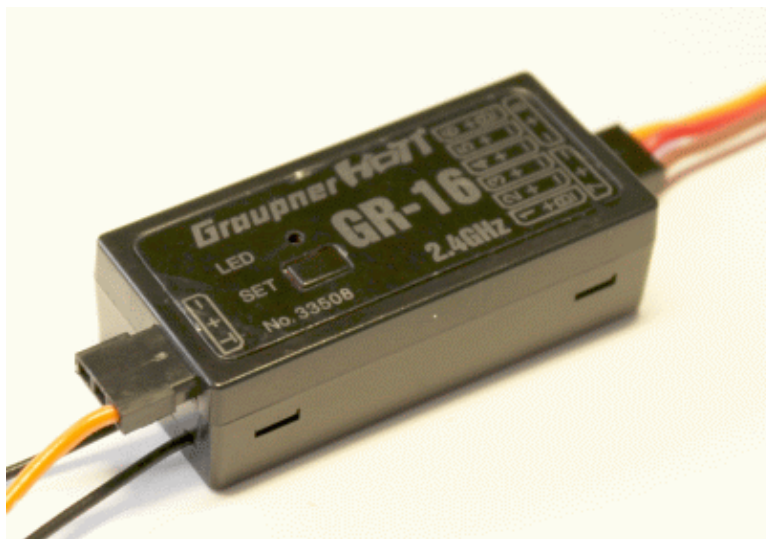
Output for the sum-signal GR-16



- The receiver has to be bound to the transmitter (see: "Binding").
- The !Sum-signal must be activated (see: ["Set receiver to sum-signal"](#)).
- The !Sum-signal is on output 8.

Telemetry connection GR-16

The receiver has a separate data channel on the other side of the receiver for the [MikroKopter](#)-Telemetry:



4.4 Receiver GR-24

The GR-12 HoTT is a 12-channel receiver and is able to provide up to 16 channels throughout the sum-signal (depends on the transmitter).

The range with this receiver is according [Graupner](#): 4000mtr.

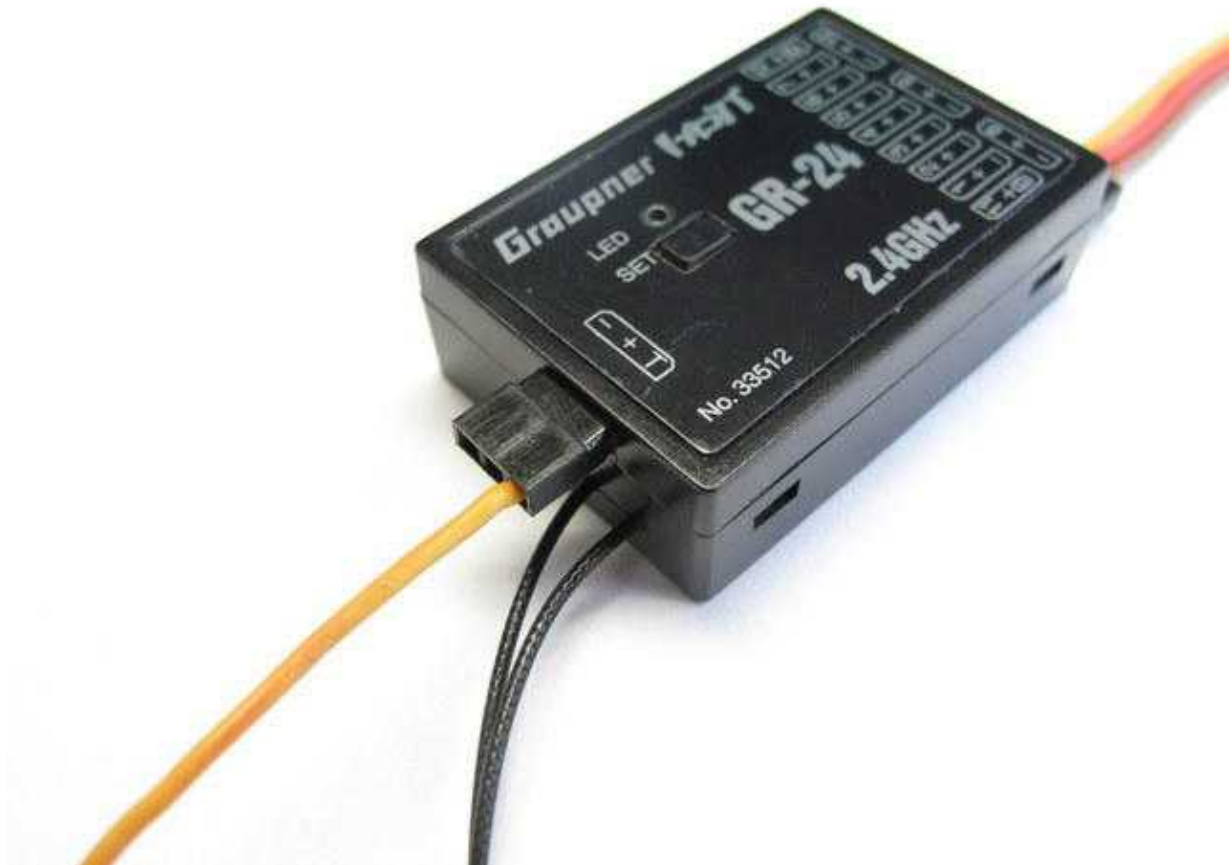
Output for the sum-signal GR-24



- The receiver has to be bound to the transmitter (see: "Binding").
- The !Sum-Signal must be activated (see: ["Set receiver to sum-signal"](#)).
- The !Sum-signal is on output 8.

Telemetry connection GR-24

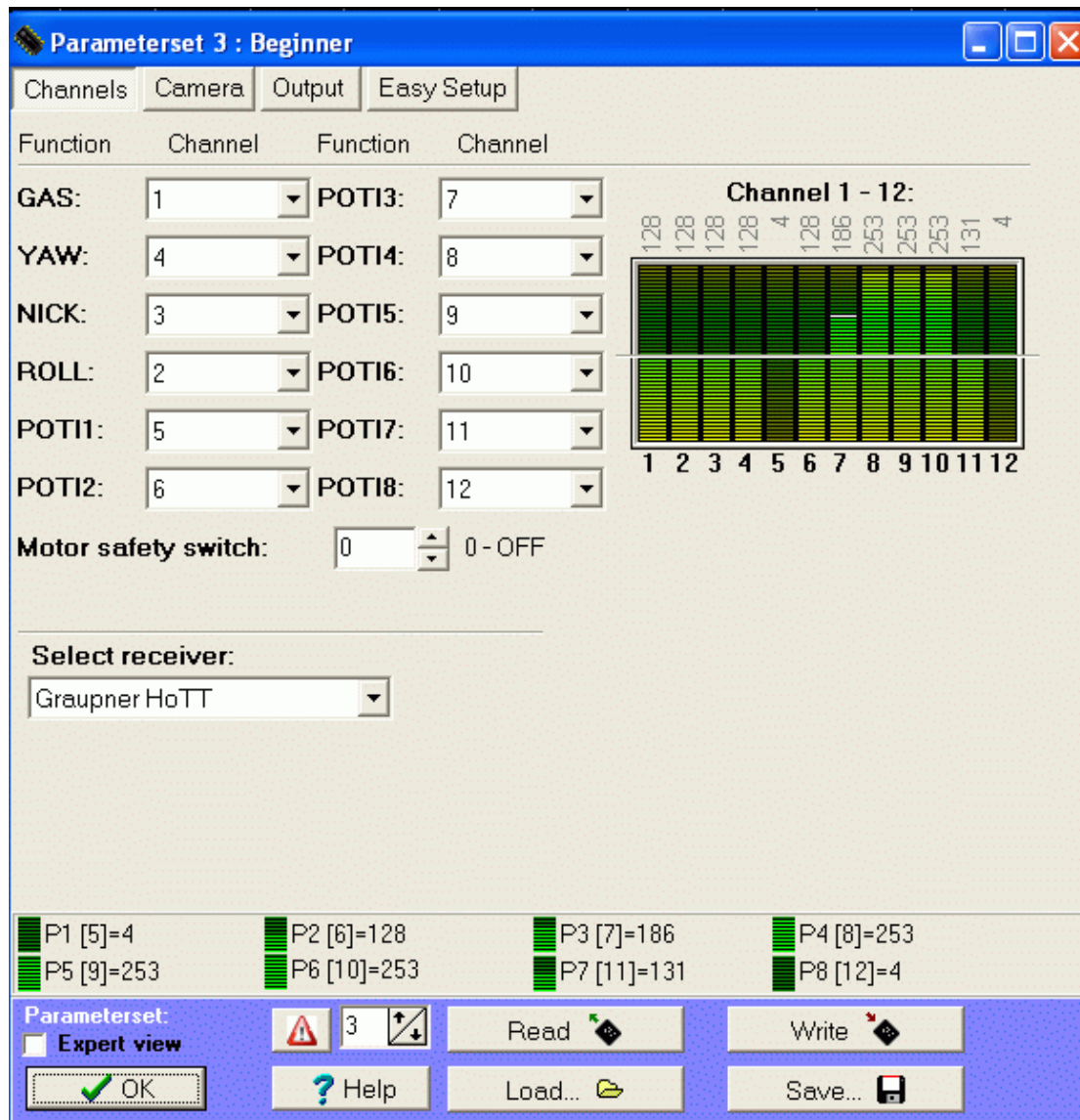
The receiver has a separate data channel on the other side of the receiver for the [MikroKopter](#)-Telemetry:



5 Check function receiver and channels in the KopterTool

If the receiver is connected to the FlightCtrl and the transmitter is switched on you can check in the KopterTool the channel assignment.

By operating the appropriate control on the transmitter you can see the peaks of the signal.



Hints:

- As a type of the receiver you **must** set "Graupner HoTT".
- Therefor the telemetry will be activated and set to the correct channel-offset (Otherwise the zero value would be 133 instead of ca. 128)
- ⓘ If you change the type of the receiver you need to save the setting first in the MK (Write) so that the change will be active.
- The peaks of the sticks (Nick/Roll/Gas/Yaw) need to have in the middle-position 127 or 128. You can adjust it with the trim button (next to the sticks).

6 Telemetry settings

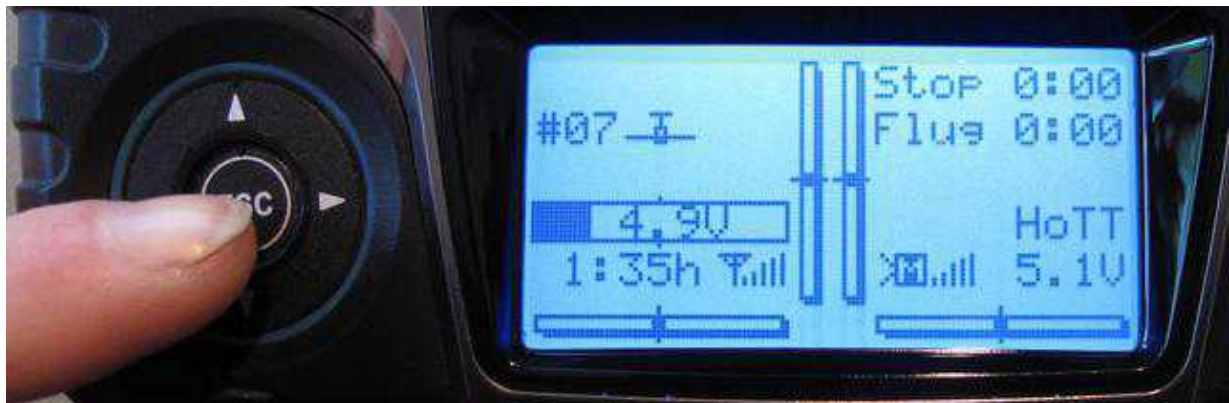
Via the telemetry screen you can display different values over different menus:

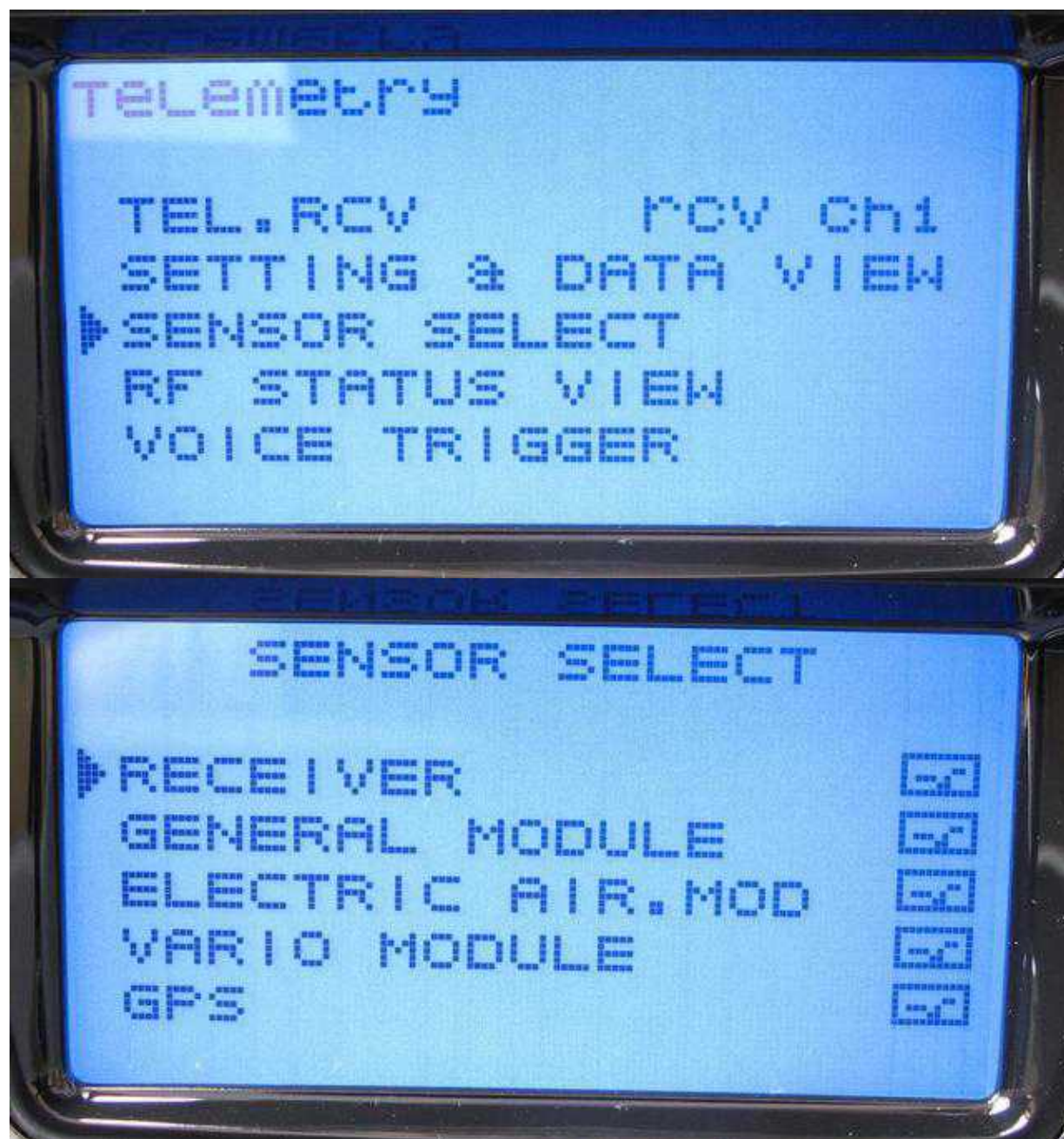
- Current [LiPo](#) voltage
- Current consumption
- Consumed Lipo-capacity
- Height / Altitude
- Direction
- Number of satellites and SatFix
- Flight speed
- Distance and direction to the "Homeposition"
- Error messages
- Magnet value and in clination
- Temperature of the BL-Ctrl's
- [FailSafe](#) value
- Home Altitude
- Used Setting

6.1 Select Sensor

So that the telemetry data can be displayed you need to set the appropriate sensors on the transmitter.

- In the opening screen of the transmitter press **ESC** for around ~2 seconds to switch into the telemetry.
- With UP/DOWN choose **SENSOR SELECT** and open it with "SET".
- Here you can select all sensors.





7 Telemetry display

On your transmitter you have the opportunity to display the telemetry in two different menus:

Summarized you can find the values of the telemetry in the **MikroKopter-Menu**:



Or with more and detailed information on several pages in the **Text-Telemetry**:



⚠ Please note: An audio output as well as logging the GPS position on your transmitter is only with the **MikroKopter-Menu** to the same time possible.

If you are in the **Text-Telemetry** the voice output and the GPS-Logging to the Micro-SD-Card in your

transmitter is during that time not possible!

7.1 MikroKopter-Menu

⚠ So that the "MikroKopter-Menu" displays the right values you need to select the sensor "GPS".

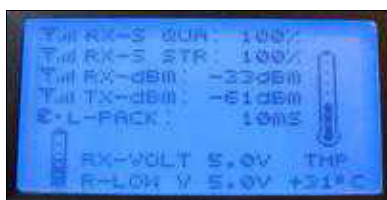
On your transmitter you will find an extra **MikroKopter-Menu** which displays you summarized the most important telemetry values.

Out of the main menu you will get into the telemetry display by pressing UP/DOWN/LEFT/RIGHT of the transmitter.

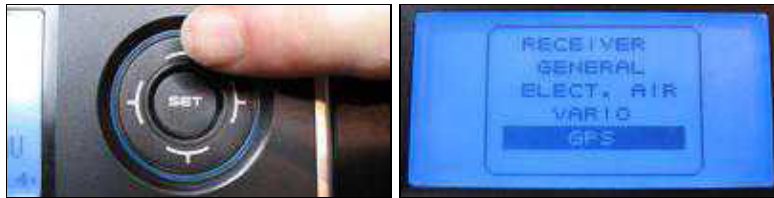
You can browse it with the LEFT/RIGHT button to get into the **MikroKopter-Menu**.



Select the GPS sensor and open the MikroKopter menu:



Step1: In the menu you can see a telemetry display.



Step2: Press the touch button (up / down) to open the Sensors screen and select **GPS**.



Step3: If the GPS sensor is selected the sensors display will close automatically. Then you will see this display.



Step4: Press the touch button (left / right) to open the MikroKopter-Menü.

The following values are displayed in the **MikroKopter-Menu**:

- Lipo voltage
- Flight Time
- Consumed Lipo-capacity
- Height / Altitude
- Direction of the Kopter
- Actual power consumption
- Numbers of satellites
- Flight Speed
- Distance and direction to the "Homeposition"

If everything is "OK" at your Kopter that will be displayed under "MikroKopter". If you have an error a message will be displayed.

7.2 MikroKopter Text-Telemetry

⚠ Please note: If you are in the **Text-Telemetry** the audio output and the GPS-Logging to the Micro-SD-Card in your transmitter is during that time not possible!

The "Text-Telemetry" you can open via the menu "Telemetry". With the "Text-Telemetry" you are able to display more telemetry values.

- In the opening screen of the transmitter press **ESC** for around ~2 seconds to switch into the telemetry.
- With UP/DOWN select **Setting & Data View** and open it with **SET**.
- Now either way click 1x arrow "UP" or 6x arrow "RIGHT".
- The Text-Telemetry will open.





Here the following values will be displayed:

- Lipo voltage
- Flight Time
- Consumed Lipo-capacity
- Height / Altitude
- Direction of the Kopter
- Actual power consumption
- Numbers of satellites
- Flight Speed
- Distance and direction to the "Homeposition"

If everything is "OK" at your Kopter that will be displayed under "MikroKopter". If you have an error a message will be displayed.

If you press one time the **SET** button you can display the magnet value and the inclination:



With the arrow keys LEFT/RIGHT you can open two additional displays in the "Text-Telemetrie":



Anzeige:

- Flight Time
- Lipo voltage
- Consumed Lipo-capacity
- Direction of the Kopter
- Height / Altitude
- Direction to the Homeposition

- Distance to the Homeposition
- Power consumption
- Flight Speed
- Numbers of satellites + Fix
- Temperature of each BL-Ctrl

and



Display:

- Used Setting
- Min. voltage for low-voltage warning (battery)
- The set Kopter-Type
- Mode and switch status "Altitude switch"
- Mode and switch status "CareFree"
- Mode and switch status "GPS" + FailSafe Time
- The set FailSafe Height
- Position of the control sticks (Ni=Nick, Ro=Roll, GS=Gas, Ya=Yaw, C=Nick camera mount)

7.3 Telemetry - additional Info

In addition to the described telemetry display you can see some additional information / symbols.

These are as follows:

- '-' = No GPS fix
- '/' = off

- '?' = Coming home, but home Position unknown (goes to PH then)
- 'H' = Coming home
- 'W' = Flying Waypoints
- 'D' = Dynamic Position Hold
- 'P' = Position Hold
- 'm' = Manual controlled

8 Set voice output and Vario

With the integrated speaker or with headphones you can hear the chosen telemetry values.

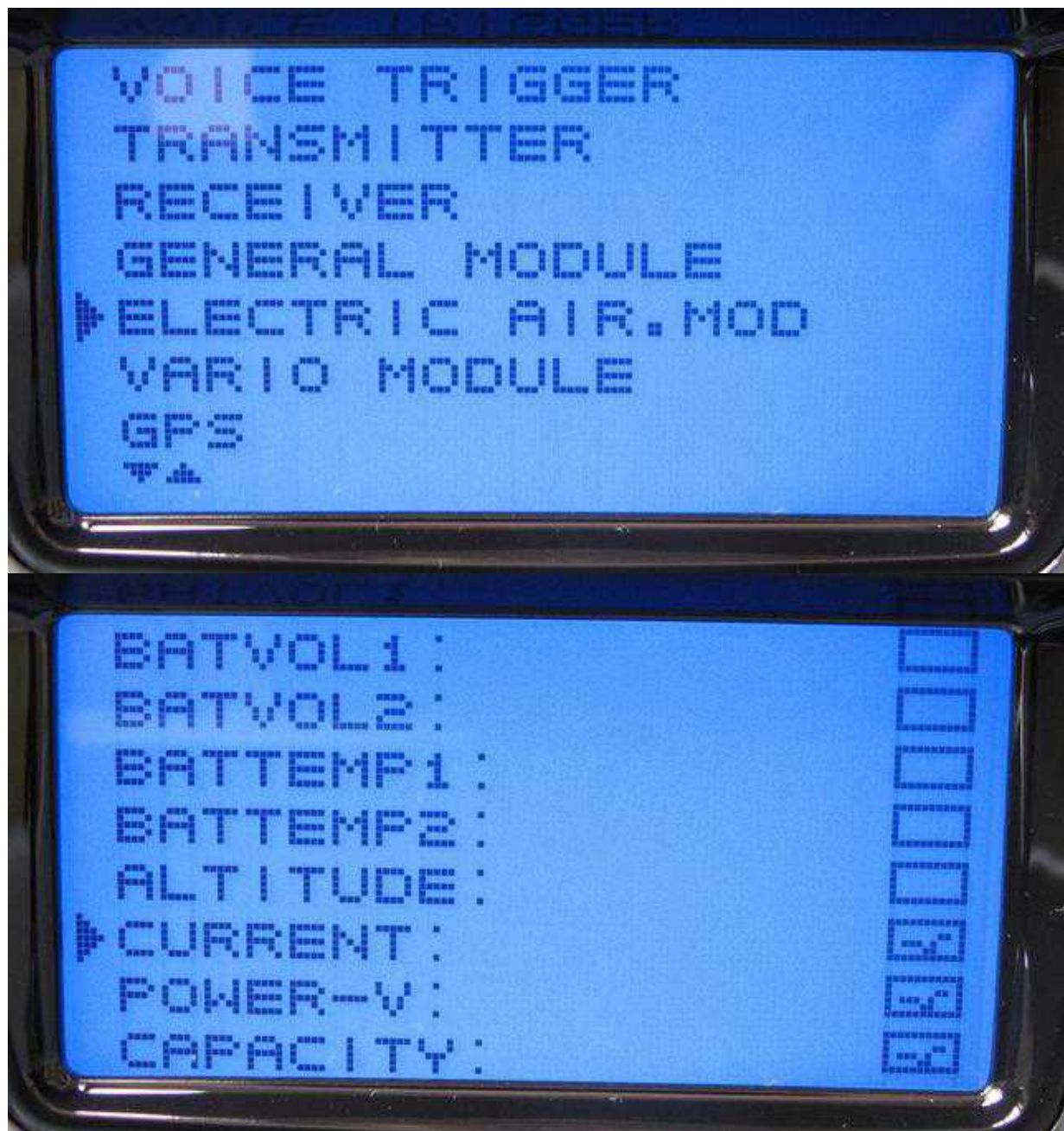
8.1 Selection of announcements

In the settings you can choose which telemetry values should be issued:

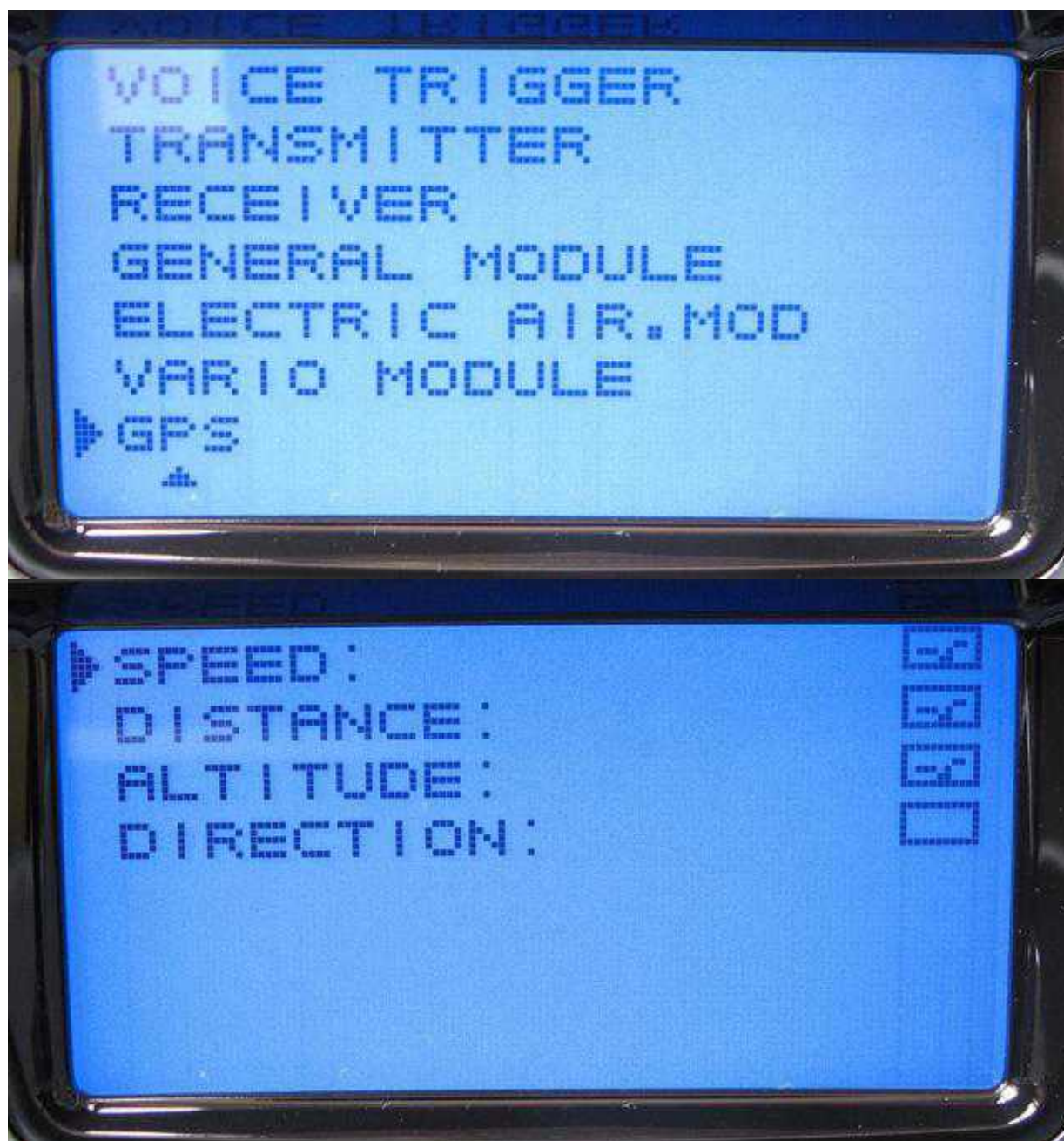
- In the opening screen of the transmitter press **ESC** for around ~2 seconds to switch into the telemetry.
- With UP/DOWN select **Voice Trigger** and open it with **SET**.
- Select here the appropriate sensor (i.e. "ELECTRIC AIR-MODUL" and "GPS") and open it with **SET**.
- In the opening window you can select the desired menu points for the voice output.



Browse down to "ELECTRIC AIR-MODUL":



And the settings on "GPS":



8.2 Announcements "All Messages" or "Warnings only"

Additionally, you can choose messages you want to hear.

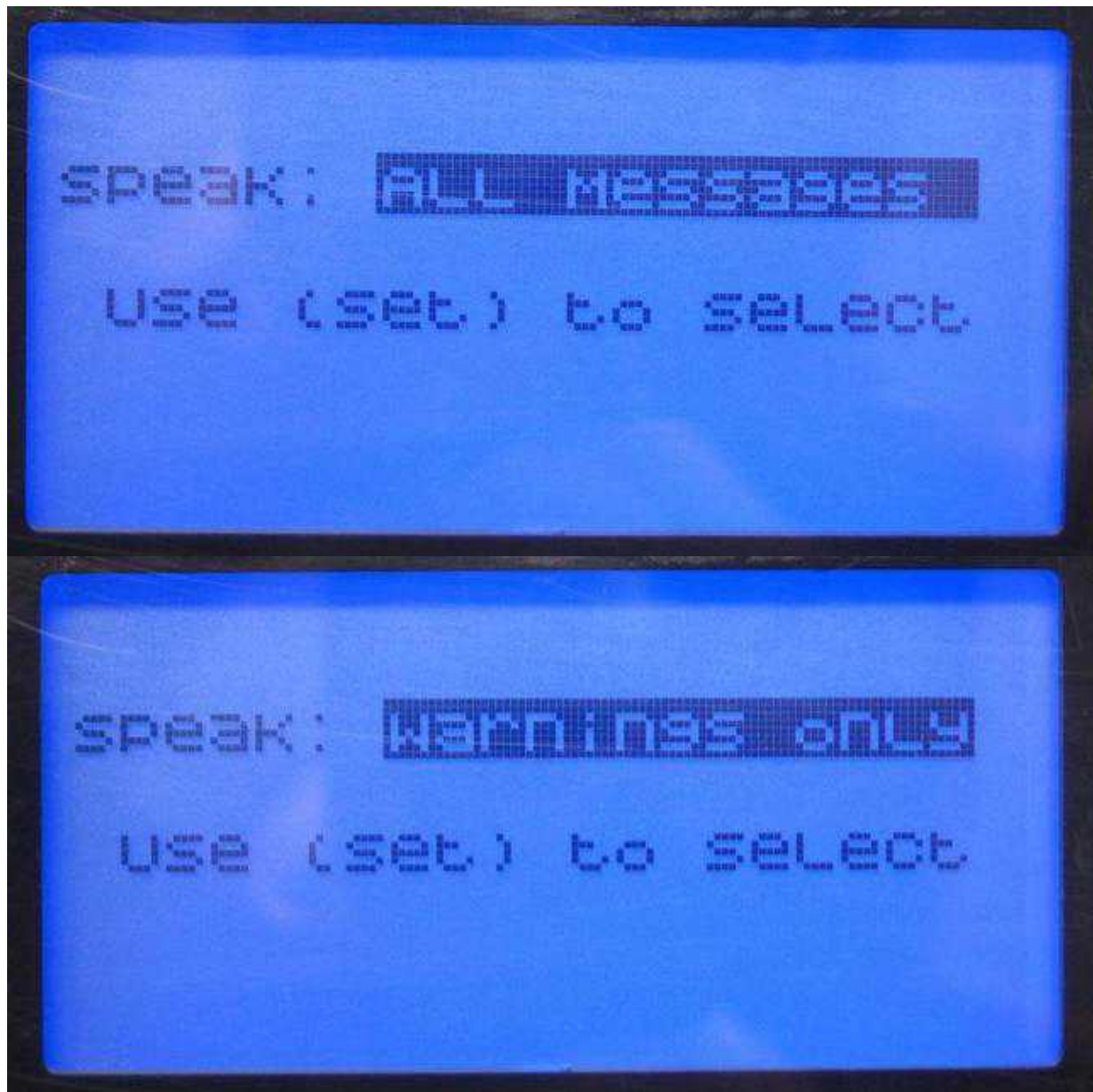
If you e.g. will not hear a message if you switch a function (like GPS, altitude, CareFree, etc.) you can change it.

Therefore you can switch between "All Messages" or "Warnings only":

- In the opening screen of the transmitter press **ESC** for around ~2 seconds to switch into the telemetry.
- With UP/DOWN select **Setting & Data View** and open it with **SET**.
- Now either way click 1x arrow "UP" or 6x arrow "RIGHT".
- The Text-Telemetry will open.



To change the announce "click" 3x the arrow "Left". Now you see the following window where you can change between "All Messages" or "Warnings only".



8.3 Voice output set to a button

To get the selected values one after the other to the voice output you can use here a button on your transmitter.

That need to be set also in the menu "Telemetry":

- In the opening screen of the transmitter press *ESC* for around ~2 seconds to switch into the telemetry.
- With UP/DOWN select **Voice Trigger** and open it with *SET*.

- Here switch to **TRIG** and activate it with **SET**.
- An information opens up: "Desired switch to ON Position (Ext. Switch: SET)"
- Push now the desired button on your transmitter.



8.4 VARIO-Altitude regulator via loudspeaker

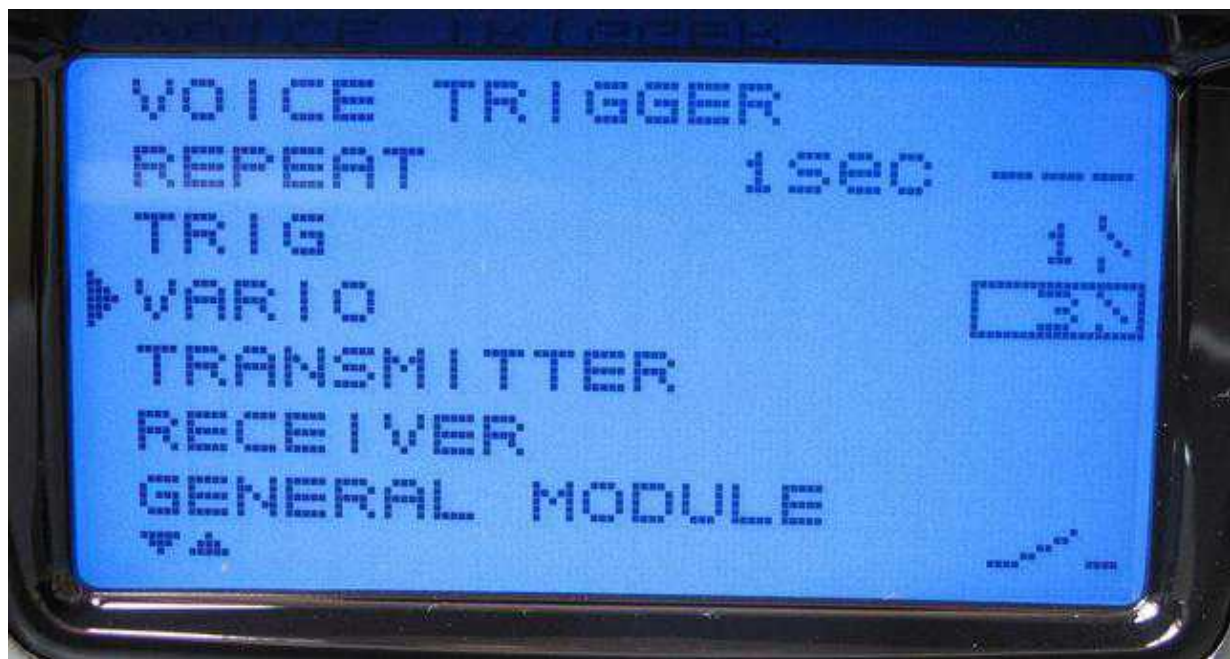
Like the voice output a tone can be issued for the climb and the fall via the switched-on altitude regulator on your transmitter.

It is recommended for that function to use that switch which is used to switch ON/OFF the "Altitude hold".

We switch again into the menu "Telemetry":

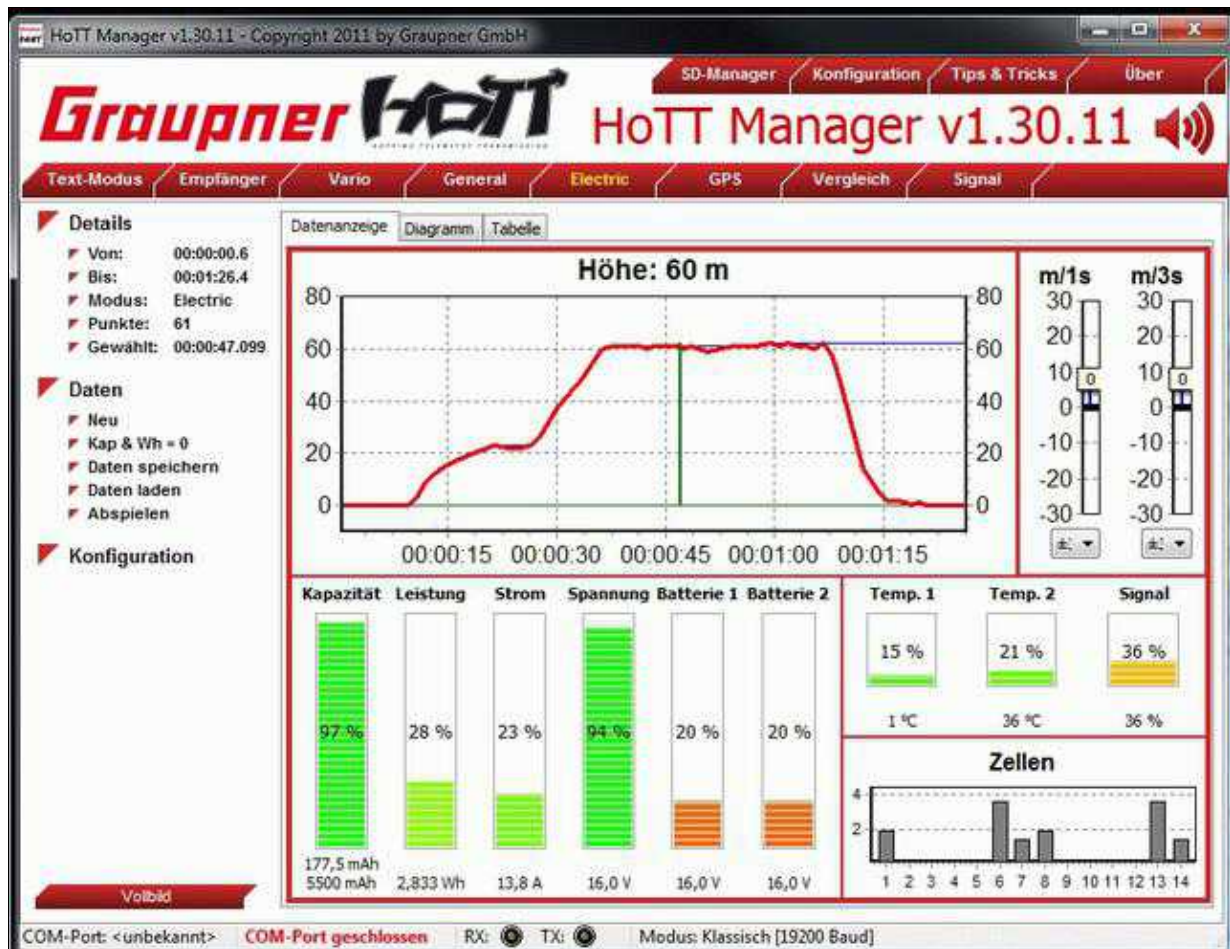
- In the opening screen of the transmitter press *ESC* for around ~2 seconds to switch into the telemetry.
- With UP/DOWN select **Voice Trigger** and open it with *SET*.
- Switch here to **VARIO** and activate it with *SET*.
- An information opens up: "Desired switch to ON Position (Ext. Switch: SET)"
- Push now the desired button on your transmitter.





9 Logfile in the Transmitter

The HoTT Telemetry data can be logged on a SD card in the HoTT-Transmitter. Just in case you would loose a [MikroKopter](#), you could see the last GPS Position in the Logfile of the Transmitter.



(Graupner HoTT Manager)

SD Log Converter - Version 1.1

File: C:\Daten\LOG\20120516\0030_2012-5-16.bn

General | Electric | GPS | Vario | Receiver | RF RXSQ | Channel

No	Time	RF RXSQ	Direct	Speed	NS	NS-H	NS-L	EW	EW-H	EW-L	Distance	Altitude	Alt 1sec	Alt 3sec
72	+ 71.70 sec	28	200	27	0	5328	5374	0	748	5078	37	18	-5.4	0
73	+ 72.67 sec	52	208	25	0	5328	5441	0	748	5078	37	18	-4.4	0
74	+ 73.89 sec	0	196	21	0	5328	5500	0	748	5078	37	18	-3.2	0
75	+ 75.28 sec	58	184	14	0	5328	5590	0	748	5078	37	18	-0.9	0
76	+ 76.30 sec	0	190	8	0	5328	5612	0	748	5078	37	18	0.0	0
77	+ 77.49 sec	71	196	5	0	5328	5626	0	748	5078	37	18	0.0	0
78	+ 78.46 sec	72	204	5	0	5328	5640	0	748	5078	37	18	-0.1	0
79	+ 79.46 sec	67	204	4	0	5328	5653	0	748	5041	9	1	0.1	0
80	+ 80.49 sec	80	202	1	0	5328	5659	0	748	5044	8	1	0.0	0
81	+ 81.50 sec	72	202	2	0	5328	5660	0	748	5055	8	0	0.0	0
82	+ 82.69 sec	0	198	5	0	5328	5668	0	748	5068	7	0	0.0	0
83	+ 83.70 sec	73	194	2	0	5328	5675	0	748	5074	6	0	0.0	0
84	+ 84.87 sec	35	182	0	0	5328	5675	0	748	5076	6	0	0.0	0
85	+ 85.90 sec	41	182	0	0	5328	5675	0	748	5075	6	0	0.0	0
86	+ 87.07 sec	76	182	0	0	5328	5671	0	748	5075	6	0	0.0	0

GPS00001.XML - Notepad++

```

152: +7.4850447,+53.2856596,3.302
153: +7.4850483,+53.2856603,3.001
154: +7.4850551,+53.2856632,2.507
155: +7.4850643,+53.2856686,2.198
156: +7.4850689,+53.2856717,2.218
157: +7.4850739,+53.2856742,1.949
158: +7.4850759,+53.2856768,1.639
159: +7.4850766,+53.2856770,1.528
160: </coordinates>
161: </LineString>

```

Normal text file 4478 chars 4806 bytes 163 lines Ln: 155 Col: 29 Sel: 0 (0 bytes) in 0 ranges Dos/Windows ANSI IN5

(Graupner grStudio => Log View)

9.1 Starting the SD-Logging in the Transmitter

- to start the logging, the "flight time counter" in the transmitter must be started
- under "Flight timers" in the menu of the transmitter you can assign a switch to start the flight timer (see the manual of the Transmitter)
- A small SD-card-Symbol will appear on the LCD when the logging runs

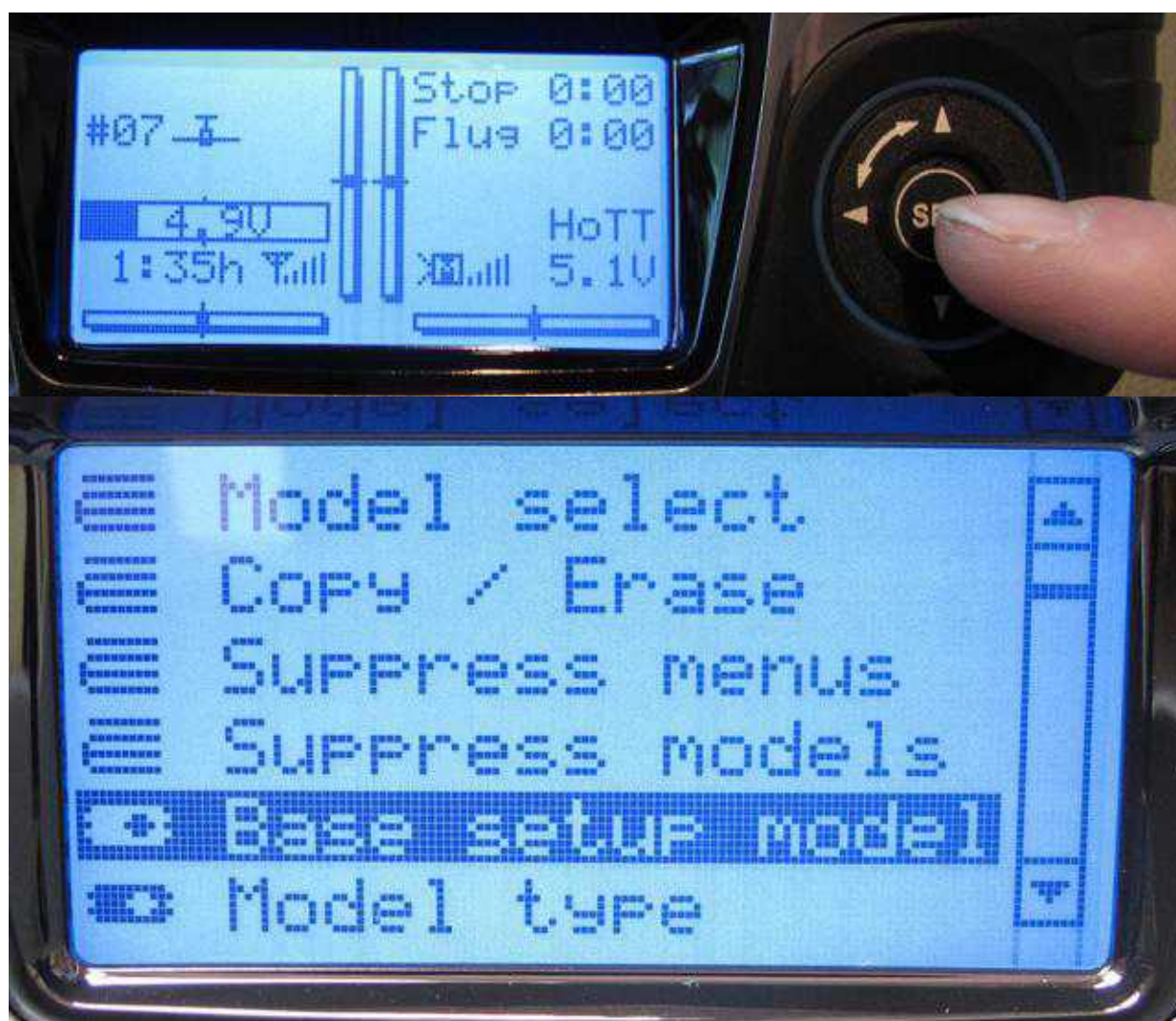
You can start the "flight time counter" with a switch or a stick, but you can not stop it with the same. For this you have to press "ESC".

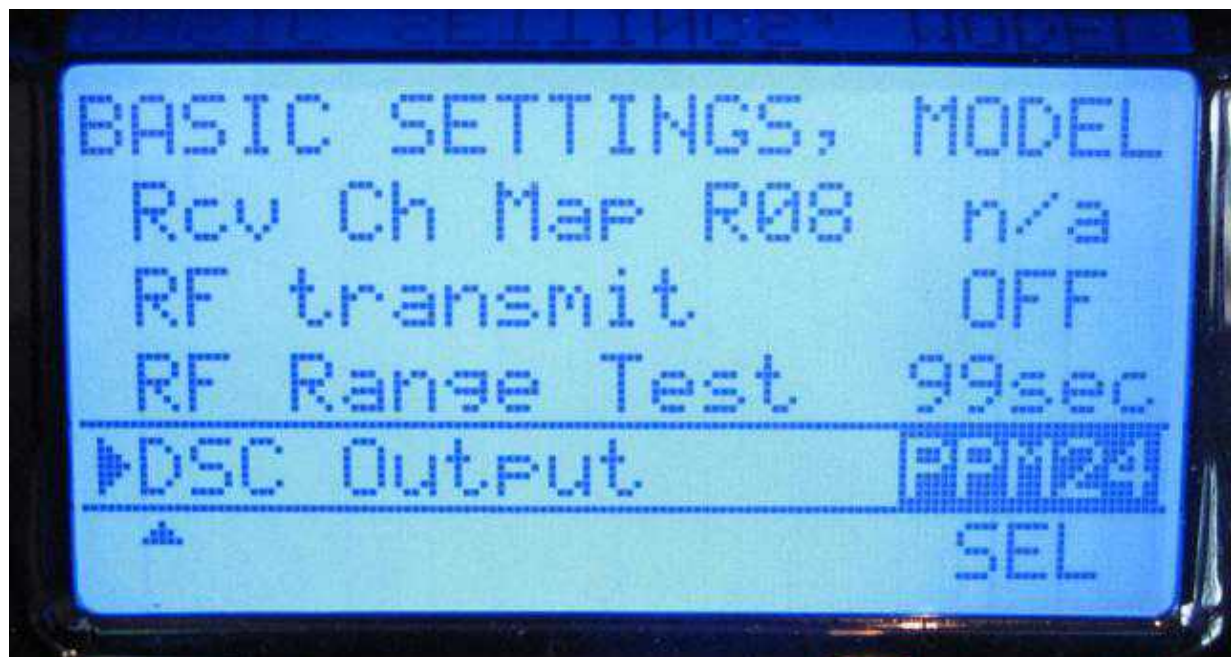
10 Setting for a flight simulator or trainer mode

You can also use the transmitter with an flight simulator or for the trainer mode. To use all channels of this transmitter you should change the **DSC Output** to **PPM24**.

If you do not change this you can only use the first 5 channels of this transmitter with an flight simulator or for the trainer mode.

- In the opening screen of the transmitter you need to press on **SET** to enter the settings.
- With the arrow keys UP/DOWN you choose the entry **Base setup model** and with the key **SET** you open it.
- Here you switch to the entry **DSC Output** and choose it with the **SET** button.
- With the arrow keys you can set now "PPM24" and save it with "SET".



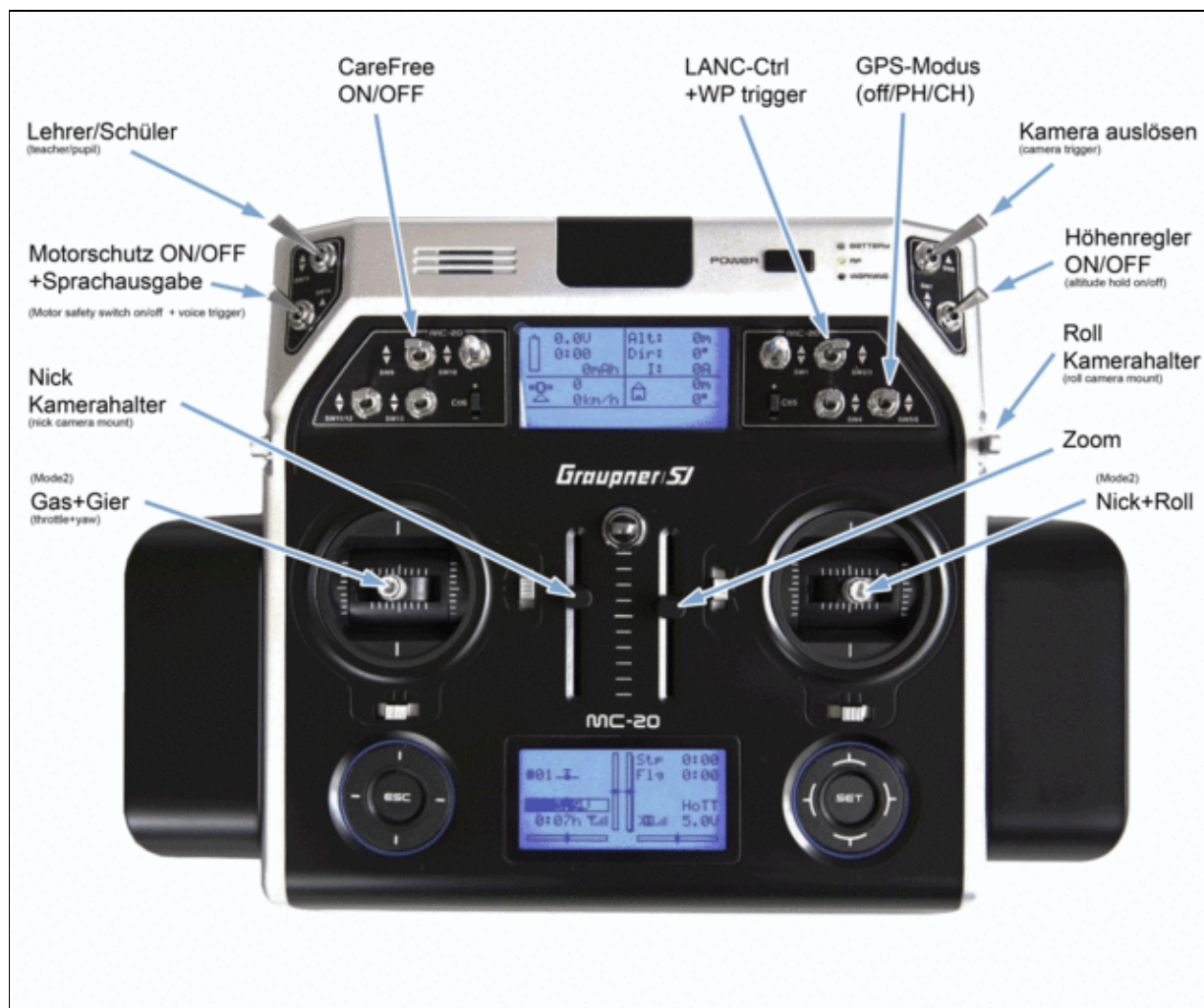


11 Example: Setting - Download

11.1 Modell memory for transmitter

💡 A "ready to use"-setting like above you can download here:

- [Download modell memory \(for MC-20\)](#)



(To enlarge -> click on the image)

After downloading the file (aMK MC-20.mdl) you can copy it directly into a folder "Models/mc-20" on a Micro-SD-Card.

How you import model memories from the Micro-SD-Card into your transmitter can be read in the instruction on page 66 (Chapter: Import SD).

>

INFO:

If you insert an empty Micro-SD-Card into the transmitter and switch it on, automatically the needed

directories will be created.

In this model memory is the upper right **Flight-Time counter/Flt** active. This one is set in that way as soon as the Gas-Stick will be moved upwards the Flight-Time counter starts.

This Flight-Time counter is required so that the GPS position data of the Kopter can be saved on a Micro-SD-Card in your transmitter.

So, if the Kopter is maybe getting lost you still have then the last received coordinates of the Kopter.

Is the Gas-Stick down this counter still continues! (Instruction see page 139)

To stop it you can push the **ESC** button.

To reset the Flight-Time counter you need to push the UP/DOWN (or LEFT/RIGHT) button to the same time on the right Touch-Pads.

(Instructions of the transmitter - page 138 + 252)

 The channels in both model memory are set as you can see here.

If you use this model memory you have to set this functions/channels in the settings of the [FlightCtrl](#). (or you download the setting below and update your [FlightCtrl](#) with this setting.)

Kanalbelegung MikroKopter					
Kanal (Channel)	Belegung im KopterTool (Assignment in the KopterTool)	Funktionen (Functions)	MX-20 (Mode2)	MC-20 (Mode2)	MC-32 (Mode2)
1	Gas (throttle)	Steuerung Gas (Control throttle)	Steuerknüppel links (Control stick left)	Steuerknüppel links (Control stick left)	Steuerknüppel links (Control stick left)
2	Roll	Steuerung Roll (Control roll)	Steuerknüppel rechts (Control stick right)	Steuerknüppel rechts (Control stick right)	Steuerknüppel rechts (Control stick right)
3	Nick	Steuerung Nick (Control pitch)	Steuerknüppel rechts (Control stick right)	Steuerknüppel rechts (Control stick right)	Steuerknüppel rechts (Control stick right)
4	Gier (yaw)	Steuerung Gier (Control yaw)	Steuerknüppel links (Control stick left)	Steuerknüppel links (Control stick left)	Steuerknüppel links (Control stick left)
5	Pot11 (Ch5)	Funktion Höhenhalten (Function Altitude control)	SW 3	SW 7	(left) SW 3
6	Pot12 (Ch6)	Funktion GPS (PositionHold / ComingHome) (Function GPS (PositionHold / ComingHome))	CTRL 10	SW 5/6	(left) SW 6
7	Pot13 (Ch7)	Kamera Zoom (Camera Zoom)	CTRL 6	Schieber rechts (Slider right)	Schieber rechts (Slider right)
8	Pot14 (Ch8)	Funktion Carefree (Function CareFree)	SW 2	SW 9	(right) SW 4
9	Pot15 (Ch9)	Kameraneigung (Wack) (Camera tilt (Pitch))	CTRL 7	Schieber links (Slider left)	Schieber links (Slider left)
10	Pot16 (Ch10)	Kameraneigung (Roll) (Camera tilt (Roll))	CTRL 8	Potenziometer	Potenziometer
11	Pot17 (Ch11)	Kamera auslösen (SLR - ModeSp.1 / LANC - ModeSp.2) (Trigger camera (SLR - ModeSp.1 / LANC - ModeSp.2))	SW 5 (CTRL9)	SW 8	(rechts/right) SW 8
12	Pot18 (Ch12)	Funktion Motor-Sicherheitsschalter & Sprachausgabe (Function Motor-Safety switch & Voice output)	SW 1	SW 14	(links / left) SW 7
13	Ch13	Funktion Auto Start/Land	-	-	(rechts/right) SW 1

(to enlarge -> click image)

TIPP: If you use a different mode rather than **Mode 2** you are still able to use the downloaded model memory.

After downloading the model memory you can set the desired mode (1,3,4) by yourself (Instruction manual page 68).

The control sticks have then the channels/function of the set mode. All other switches/channels remain as described in the example.

11.2 Setting FlightCtrl

Here you find a setting for the FlightCtrl (from V2.02): [Download](#).
The settings are adjusted with the model memory for the MC-20.

To load the setting into the FlightCtrl, open the settings of the KopterTool.

Here "click" the button **Load** in the bottom bar and open the downloaded setting "MK-Setting_(V2.00).mkp".
After this "click" the button **Write** to set the setting into the FlightCtrl.



Note:

The FlightCtrl have 5 Settings you can save. If you want to use the downloaded setting in all 5 settings you have to open each setting single and save the downloaded setting there.
After you save the setting into the FlightCtrl you have to set the right Mixer ([Link](#)).

See also:

- [Firmware-0.88](#)
- [HottUpdate](#)

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- [KategorieFernsteuerung](#)